THE WEEK'S EVENTS

Prevailing Wage Set In Cement Plants

Rates are established for labor in plants making cement for sale to government

Acting under the provisions of the Walsh-Healey government contracts act, the Public Contracts Board has recommended to the Secretary of Labor a schedule of minimum wages for inclusion in future contracts between portland cement manufacturers and dealers and the various branches of the federal government. The recommendation will be held open until Sept. 7 to permit filing of briefs of objection or approval by interested persons.

Determined after public hearings attended by representatives of nineteen manufacturers and of labor organizations, the proposed rates are based largely upon wage data received from 140 plants located in 35 states and employing over 25,000 workers. Because of the wide variation in wage rates actually paid in various sections of the country, eleven regional minimums were established, as follows:

Pennsylvania, New York, New Jersey, Maryland, West Virginia, Ohio	$.57
Maine	.45
Michigan, Indiana, Kentucky	.50
Illinois	.62½
Wisconsin, Minnesota, Iowa, Missouri	.55
South Dakota, Nebraska, Kansas	.50
Colorado, Wyoming, Utah, Idaho, Oregon	.55
Washington	.65
California	.62½
Oklahoma, Texas, Arkansas	.43
Louisiana, Alabama, Tennessee, Virginia, Georgia, Florida	.40

(States omitted from this list have no present cement plants.)

The board recommends that these wage scales be applied to manufacturers of portland and puzzalon cements, and to the manufacture of masonry cements in portland cement plants. Natural cements, however, are outside the scope of the recommendations.

MAJOR NEWS

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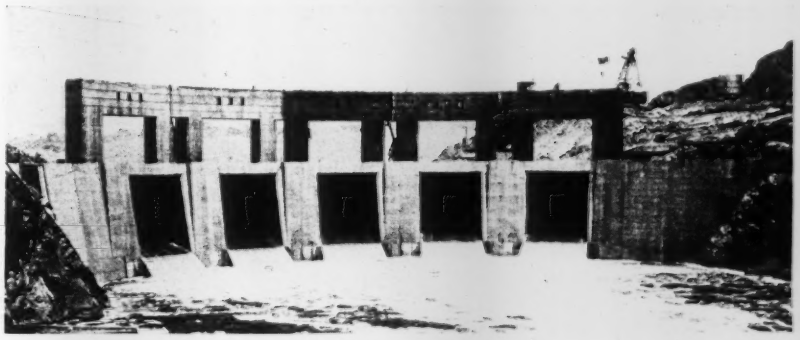

SPILLWAYS FOR PARKER DAM

THOUGH PRACTICALLY COMPLETED, Parker Dam on the Colorado River shows the camera only a small fraction of its great bulk. With the deepest foundation of any dam in the world, 235 ft. of its 280-ft. overall height are submerged.

Parker Dam, 155 miles below Boulder Dam, was built by the Bureau of Reclamation with funds provided by the Metropolitan Water District of Southern California. It forms the lake from which water is taken by the Colorado Aqueduct for delivery to thirteen California cities. Flow of the river is controlled by five gates.

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Gastroenteritis Epidemic In Milwaukee

A new outbreak of gastroenteritis in Milwaukee has been reported by health commissioner John P. Koehler. He says that several thousand people are affected. Although fewer cases are reported, so far, than in the epidemic of last February, individual cases are more severe.

As in the case of the February epidemic, Koehler believes that the city water supply is not involved. He points out that the Bacillus Coli count is below 4 per 100 c.c.

Last February's outbreak lead to a controversy between Koehler and the state health department, the health department contending that pollution of the water supply caused the epidemic. The U. S. Health Service was recently asked to decide between the conflicting viewpoints, and H. W. Streeter, sanitary engineer for the service, is in Milwaukee investigating the situation.

PWA Penalizes Sponsors For Lobbyist's Activity

PWA last week announced final action on all but one of eleven California projects which have been held up because of alleged employment of a lobbyist, Glenn E. Miller, to expedite their dealings with PWA. (*ENR*, July 28, 1938, page 99.)

With three of the projects Miller had no connection, it was found. Final grant payment was, therefore, approved on a disposal plant project at Tehachapi, and consideration was resumed of applications for sewer and water works projects at San Gabriel and South Laguna respectively.

Sponsors of seven remaining projects were found to have employed Miller. Allotments on projects on which construction had not started, therefore, were rescinded; and where construction had been started, the PWA grant was reduced by the amount of money paid to Miller. A project at Riverside, on which an application was pending, was disapproved. Two projects in Orange County and projects in Upland and Santa Monica were rescinded. Grants to El Monte and San Marino were reduced by $1,000 and $750, the amounts paid to Miller.

District Convention Sets Precedent

Michigan meeting is first to be held by a district of American Society of Civil Engineers

In spite of the fact that the districts of the American Society of Civil Engineers have hitherto been looked on primarily as paper organizations, existing largely for the purpose of delimiting an area from which a director may be elected, District 7 of the society held a three-day membership convention at Houghton, Mich., Aug. 25-27 at the Michigan College of Mining and Technology.

Discussing current problems of the society, Louis E. Ayres, director of the district, drew attention to the need for the sections to increase their membership, carry on an active program, and exert professional leadership in their area. The corporate list of the society, he said, has not grown recently, being now 450 less than at the peak period of 1932. To increase the membership roll in a dignified manner without a "campaign" is one of the sections' major jobs.

H. E. Riggs, president of the society, discussed problems of the junior members, elaborating a statement by Ayres that these are largely welfare problems and come within the field of the new committee on professional objectives. The society rolls indicate, Riggs said, that juniors make up nearly a quarter of the membership. This is a result of the drive for student chapters. Riggs said that the junior is entitled to much more attention from the local section than in college.

W. W. DeBerard, director from the eighth district, suggested, in discussing Riggs' paper, that employers make arrangements to give junior members approaching the age limit at least a year's responsible charge of work so that they may meet the requirements for associate membership.

This would demand, he said, more active personnel work in the section. He said that a survey of jobs available and the number of graduates each year is needed and that the surplus graduates who cannot be absorbed into the engineering profession should be assisted into other than technical jobs.

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Reinstatement Urged For Ohio Engineer

Ohio Attorney General H. S. Duffy, on Aug. 26, recommended that Harry A. Sparks be reinstated in his position as bituminous engineer for the Ohio highway department. Sparks was discharged last March by state highway director J. J. Jaster, Jr., shortly after he had testified before a legislative investigating committee as to alleged improper practices in the highway department (*ENR* March 10, 1938, page 353).

At the same time that he made his recommendation, Duffy announced that he was withdrawing from the defense in the suit which Sparks brought against Jaster in an effort to obtain reinstatement (*ENR*, March 17, 1938, page 386). Duffy said that he could find no defense for Jaster's action in discharging Sparks.

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Rail Relocation Bids Asked at Shasta

Bids for construction of fourteen miles of the Southern Pacific R.R. relocation around the site of the Shasta reservoir will be opened Sept. 19 by the U. S. Bureau of Reclamation. Shasta Dam, largest item in the Central Valley project of California, will flood out the existing right of way.

The contract will include excavation and grading of the roadbed from the Sacramento River bridge at Redding to the proposed Pit River crossing, as well as construction of two half-mile tunnels at Bass Hill and the erection of several minor structures. The government has already received bids for building a concrete and steel bridge to carry the railroad across the Sacramento at Redding. The relocated line will eventually extend a distance of 30 miles from Redding to Delta, replacing 37 miles of existing railroad in the Sacramento canyon.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

AMERICAN PUBLIC WORKS ASSOCIATION, annual meeting, New York City, Oct. 3-5.

THE IRON AND STEEL INSTITUTE and The Institute of Metals of Great Britain, joint meeting by invitation of the American Iron and Steel Institute and American Institute of Mining and Metallurgical Engineers, New York City, Oct. 3-25.

NATIONAL SAFETY COUNCIL, annual congress, Stevens Hotel, Chicago, Oct. 10-14.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, annual convention, French Lick Springs, Ind., Oct. 10-14.

MONTANA NATIONAL BITUMINOUS CONGRESS, Edgewater Gulf Hotel, Biloxi, Miss., Oct. 10-13.

NATIONAL RECLAMATION ASSOCIATION, annual meeting, Reno, Nev., Oct. 11-13.

AMERICAN SOCIETY OF CIVIL ENGINEERS, fall meeting, Rochester, N. Y., Oct. 12-14.

AMERICAN WELDING SOCIETY annual meeting, Book-Cadillac Hotel, Detroit, October 16-21.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual convention, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 17-19.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Pittsburgh, October 17-19.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION, annual meeting, Hotel Stephens, Chicago, October 18-20.

CANADIAN INSTITUTE OF SEWAGE AND SANITATION, annual convention, Royal York Hotel, Toronto, October 20-21.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, Kansas City, October 25-28.

LOCAL AND REGIONAL

AMERICAN WATER WORKS ASSOCIATION, local section meetings scheduled: Rocky Mountain, Casper, Sept. 12-13. New York, Poughkeepsie, Sept. 22-23. Wisconsin, in Milwaukee, Oct. 10-12. Four States, Washington, October 6-7. South West, Oklahoma City, Oct. 17-20. New Jersey, Asbury Park, Oct. 21-22.

CALIFORNIA SEWAGE WORKS ASSOCIATION, joint meeting with California League of Municipalities, Santa Barbara, September 6-7.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, Regional Conference on Surveying and Mapping, University of Louisville, Louisville, Ky., Sept. 5-8.

WESTERN SAFETY CONFERENCE, annual meeting, Los Angeles, Sept. 12-15.

NEW ENGLAND WATER WORKS ASSOCIATION, annual convention, Hotel Statler, Boston, Sept. 13-16.

ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION, annual meeting, Casper, Wyo., Sept. 14.

NEW ENGLAND SEWAGE WORKS ASSOCIATION, and New York Sewage Works Association, joint meeting, Hotel Bond, Hartford, Oct. 6-8.

MICHIGAN ASSOCIATION OF ROAD COMMISSIONERS AND ENGINEERS, Michigan State College, East Lansing, Oct. 25-27.

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Examinations

IOWA examinations for professional engineering, Sept. 13-14, in the Senate Chamber at the State House, Des Moines.

PERSONAL

S. S. McDIARMID, for the past 15 years city engineer of Trail, B. C., has resigned.

CARL F. MEYER has opened offices in Brainard, Minn. to practice consulting engineering.

CLARENCE M. COLE, formerly in charge of surveys at Grand Coulee Dam for the Bureau of Reclamation, has been appointed chief engineer for WPA's clearing operation in the area to be flooded by the reservoir behind the dam.

A. C. POLK, executive engineer of the Birmingham industrial water supply project, in charge of design and construction, retired from the project July 15 to devote his time to private engineering work.

CAPT. LUCIUS D. CLAY, U. S. Engineers, who has been serving in the Philippines for the past year, has been made area engineer at Dennison, Texas, site of a proposed $54,000,000 flood control and power dam. For the time being, Capt. Clay is in charge of an area office in the Little Rock District.

J. A. LYNN is to serve as sanitary engineer for rural sections of Jackson County, Mo., in which Kansas City is located. Because state laws do not provide for appointment of a public health engineer, Lynn will have the title of Deputy State Food and Drug Commissioner, his salary being paid jointly by the state and county.

R. G. HOSEA has resigned as associate engineer of the International Boundary Commission, United States and Mexico, and has become engineer-secretary of the recently organized Colorado River Board of California, with offices in Los Angeles.

FLOYD E. BATES, bridge engineer of the Missouri Pacific Line, has been made chief engineer of the railroad.

ALFRED SHERMAN, until recently resident engineer of Lockwood-Greene Engineers, Inc., New York City, has been appointed northeast representative of the Douglas Fir Plywood Association, with headquarters in New York. Mr. Sherman, a graduate in structural engineering of the Drexel Institute, was active in building construction work in the New York City area, and was with the parks commission during the development of much of the parkway system. He spent two years in South America with the Ulen Construction Company and then later worked with the International Steel Corporation, Frigidaire, and Johns-Manville before joining Lockwood-Greene.

Markham Named to Head Great Lakes Dredge

Maj. Gen. Edward M. Markham, former Chief of Engineers in the U. S. Engineer Corps and now commissioner of public works of New York City, has resigned the latter post to become president of the Great Lakes Dredge & Dock Co., Chicago.

Gen. Markham's resignation is effective Sept. 1, but he expects to divide his time between the New York City service and Great Lakes Dredge & Dock until Oct. 1.

Markham, a graduate of West Point in the class of 1899, served continuously in the army from his graduation until his retirement last October as Chief of Engineers, at age 60. He has held his New York post since that time.

Important posts that Markham has held in the army include that of assistant engineer commissioner in the District of Columbia, district engineer at Detroit, and division engineer at Cleveland.

During the war he served overseas in command of the 303rd Engineers and also as deputy director of light railways and roads. He later was chief engineer of the army of occupation.

WPA Disbursements Faster Than PWA

Total federal expenditures are only slightly higher than last year but due to rise

WPA is making good in its effort to fill in the gap until PWA gets going. Expenditures from July 1 to August 15 totaled $265,067,000, more than $80,000,000 ahead of the corresponding period of 1937. That agency is spending at twenty times the rate of PWA, which distributed $13,780,000 from July 1 to August 15. Practically all of that total came from the previous program. Only $100,000 of the new money for non-federal public works actually has been paid out.

This does not mean that PWA has been slow. It has done a remarkable job of allocating the new money. Between 4,000 and 5,000 projects have been examined and approved. The difficulty has been with the states and municipalities. They have not been ready to start their projects.

Construction has started on federal PWA projects which will cost more than $152,000,000, including more than 80 per cent of all the federal projects allotted. The non-federal program is slower in getting started, with a total of 104 non-federal projects costing $48,617,000 already under construction.

There has been a falling off this summer in other federal expenditures. Highway expenditures are running at less than half of last year's rate. This is due to the fact that allocations were delayed this year. Highway work again is assuming large volume, however, and disbursements will be at about last year's rate for the last half of the calendar year.

Expenditures on reclamation projects have been running behind, but they will soon forge ahead of the 1937 rate as work increases under the new contract at Grand Coulee. Work also is getting under way on the Shasta project, on the Deer Creek dam, and on the Deschutes project.

River and harbor expenditures, while lower thus far this fiscal year, will increase as soon as easements are obtained in the lower Mississippi Valley.

Steady climb of RFC direct loans to industry continues: April, $5,103,880; May, $13,091,802.49; June, $17,656,760.21; July, $21,825,480.65.

Despite the intense desire of the administration to force funds out faster it is proving to be a difficult job. Actual expenditures for all purposes from July 1 through Aug. 22, the latest figure available at this writing, were $1,269,870,000, only $131,000,000 greater than during the same period last year.

CLEVELAND SEWAGE PLANT DEDICATED

DEDICATION of the Easterly sewage treatment works at Cleveland on Aug. 31 added another impressive disposal unit to the list of major sanitary improvements in the nation. The plant is of the activated sludge type with a capacity of 123 million gal. per day. It is the largest of three disposal plants serving Cleveland and will handle about 50 per cent of the city's sewage.

Because of its location on the shore of Lake Erie in a high class residential area, extra precautions have been taken to minimize any possibility of nuisance. It was partly for this reason that facilitates for sludge disposal were installed at the Southerly works, some 13 miles inland; primary and excess activated sludge, estimated to be about 700,000 gal. per day, will be pumped to the Southerly plant, where it will be digested, dewatered and incinerated.

Design details of the plant are given in *ENR* Jan. 9, 1936, p. 52, and in the issue of Aug. 18, 1938, p. 200.

George B. Gascoigne and Associates are consulting engineers on the project, the work on which was carried out under the direction of Frank O. Wallene, director of public utilities, and Robert Hoffman, consulting engineer and commissioner of the city of Cleveland.

Mexican Civil Engineers Form Cooperative

About 250 civil and other engineers, recently laid off for economic reasons from their positions with the Mexican Ministry of Communications and Public Works, have organized a cooperative society to build highways under contract with the federal government. This action is being taken under the auspices of President Cardenas. The first of its kind in Mexico, the society is financed by about $400,000 of federal highway funds.

Under its first contract, the society is starting work Sept. 1 on the Tamazulapam-Oaxaca branch of the Mexico City-Guatemala highway, a portion of the Pan-American highway.

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Twelve Prizes Offered For Instrument Uses

Twelve prizes, totalling $500, are being offered by the industrial instrument section of Scientific Apparatus Makers of America for unusual applications of scientific instruments. The contest is open to any engineer or operating man not employed by an instrument manufacturer. Each contestant is to write about an unusual application of a standard instrument or control device.

The contest closes Nov. 15, and the judging will be held during the week of Dec. 5. Information can be obtained from Scientific Apparatus Makers of America, 20 N. Wacker Drive, Room 3014, Chicago.

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Albemarle Sound Bridge Is Dedicated

Albemarle Sound, a 75-mile deep gash in the North Carolina coastline, a few miles south of the Virginia border, ceased, on Aug. 25, to be a barrier to highway traffic with the dedication of a 3½-mile bridge at Edenton, N. C. The bridge was opened to traffic earlier in the month, but the formal dedication was held up until the 25th, awaiting completion of approach roads.

The bridge consists of about 3.45 miles of timber-pile trestle and a 330-ft. swing span providing two 140-ft. navigation openings.

The bridge carries a 22-ft. concrete roadway supported every 25 ft. by pile bents, 4 piles to the bent, with creosoted timber caps. Spanning between bents are I-beams continuous over two spans.

In addition, a 2.4 mile approach road has been built on the north and a 6.74 mile approach on the south. The cost of the bridge and swing span was $1,365,000.

Falls View Bridge Site May Be Sold

Negotiations are now in progress between the International Railway Corp. and the Niagara Falls Bridge Commission, a New York State body, aimed at purchase by the commission of rights to the site of the wrecked Falls View Bridge at Niagara Falls, N. Y. The bridge was destroyed by ice last January.

It is understood that the sum of $750,000 is being offered to International for the rights to the site.

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Grade Crossing Deaths Drop This Year

Deaths resulting from highway-railroad grade crossing accidents during the first five months of this year totalled 590, a decrease of 164 compared with the same period last year, according to the Safety Section of the Association of American Railroads. Injuries in the same period totalled 1,683 as compared with 2,229 in the corresponding period of 1937. There were 1,409 grade crossing accidents during the five-months period this year, marking a decrease of 513 compared with the first five months of the preceding year.

Hart of Cement Group Dies in Kansas City

Walter E. Hart, district engineer for the Portland Cement Association at Kansas City, Mo., died there Aug. 1 aged 53. Hart had been with P.C.A. since 1917, entering the service as field engineer in the Minneapolis office. From 1922 to 1935 he was assistant manager and later manager of the structural bureau in the Chicago headquarters.

Educated in the University of Illinois, Hart was for a time county surveyor of Eddy County, N. D., and city engineer of New Rockford, N. D.

FREDERICK C. FRENCH, 56, assistant engineer of Chattanooga and in the Chattanooga city service since 1905, died there Aug. 20.

LINDSLEY A. MURR, former assistant to the chief engineer of the Seaboard Airline Ry. and recently assistant engineer in Jacksonville for the U.S. Engineers, died Aug. 18 in Jacksonville at the age of 53. Murr was a graduate in 1905 of North Carolina College of Agriculture & Engineering. He served briefly in the engineering department of Greensboro, N. C., and then joined the Seaboard construction force as resident engineer. In 1921, having attained the rank of assistant district engineer, he left the Seaboard to engage in contracting for a few years. He returned to the Seaboard in 1925, and remained with the line for two years. He worked with various contracting firms for a number of years and joined the U.S. Engineers in 1930.

JAMES H. BARBER, railway construction engineer in the early days of the Canadian Pacific R.R., died in Caesarea, Ont., Aug. 24, at the age of 81.

PATRICK H. NEE, district superintendent for the Chicago, Milwaukee, St. Paul and Pacific Railroad, died in Milwaukee, Aug. 24, aged 62. Nee was employed by the Milwaukee for 46 years and had been a division superintendent since 1918.

ALEXANDER NEWLANDS, until his retirement in 1933 chief civil engineer of the London Midland & Scottish Ry., died in Glasgow, Aug. 28 at the age of 68.

JAMESON VAN DERVOORT, 51, Richmond, Va., structural engineer, died there Aug. 19. Van Dervoort was for several years employed by the Truscon Co. of Youngstown and later was associated with Merrill Lee, Richmond architect.

SAM A. ROBERTSON, Texas railroad and irrigation contractor, died in Brownsville, Aug. 23. During the World War, Robertson served in France with the rank of Colonel, participating in the construction of standard gage railroads behind the front lines.

JOHN S. PEERLESS, since 1924 a civil engineer in the California department of public works, was killed in an automobile accident early last month. Missing since Aug. 4, his body was found Aug. 20 in rugged country in Yuba County.

H. B. DESPAIN MCLEOD, engineer and district superintendent in New England for the George S. May Co., of Chicago, was killed in an automobile accident at George's Mills, N. H., Aug. 25.

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Tunnel Cave-In Kills One On Ohio Railroad Line

Cave-in of a 300-ft. tunnel of the Wheeling & Lake Erie R. R. at St. Clairsville, Ohio, killed at least one man Aug. 24.

Stone had been observed falling from the tunnel roof some days previously, and it is understood that at the time of the cave-in a crew was engaged in repairing the roof.

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Massachusetts Road Fund Allotted to Cities

A controversy of some duration between advocates of centralized and decentralized control of a $5,000,000 state fund for construction of local roads and streets in Massachusetts has terminated in a victory for decentralization. The $5,000,000 was appropriated by the recently adjourned legislature from state gas tax funds.

Governor Hurley had urged that the fund be dispersed under direction of the state department of public works, while a legislative majority preferred to allocate the money to municipalities in proportion to their assessments for the state tax. The Governor finally yielded, stating that if the plan fails to work out satisfactorily to him, from the point of view of providing employment, he may call a special session to consider unemployment relief.

In the act as passed, each municipal street department has direction of the funds it receives. Municipal authorities are required to submit each project to the department of public works for approval as to necessity and location. An appeal from departmental findings may be made to the emergency finance board.

The department will furnish engineering services to the municipalities at their request.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

RURAL CARRIERS at their national convention revealed that promises already have been secured from enough members of Congress to assure an increase in the appropriation for secondary roads at the next session. The appropriation for feeder roads was cut from $20,000,000 to $15,000,000 at the last session. The carriers think $25,000,000 should be authorized.

REP. DOUGHTON, chairman of the Ways and Means Committee, expresses the hope that the one cent federal tax on gasoline can be eliminated from the next tax bill, making this source of revenue available solely to the states. More realistic members of Congress are positive in their belief that there is no chance of removing that item from the list of federal taxes.

DEFEAT in the primaries of Rep. McFarlane, of Texas, author of a bill providing for the compulsory licensing of patents, removes from the House of Representatives the most active advocate of that fundamental change in the patent system.

One of the effects of Rep. McFarlane's activities at the last session of Congress was to build up a 565-page record of testimony taken at public hearings on the bill. Testimony was offered by many outstanding witnesses to the effect that the bill would retard research and industry. Such arguments are said to have broken up an administration plan to put the bill through at the last session.

The charge was made that most of the testimony against the bill came from patent lawyers, chemists, and engineers who serve large interests.

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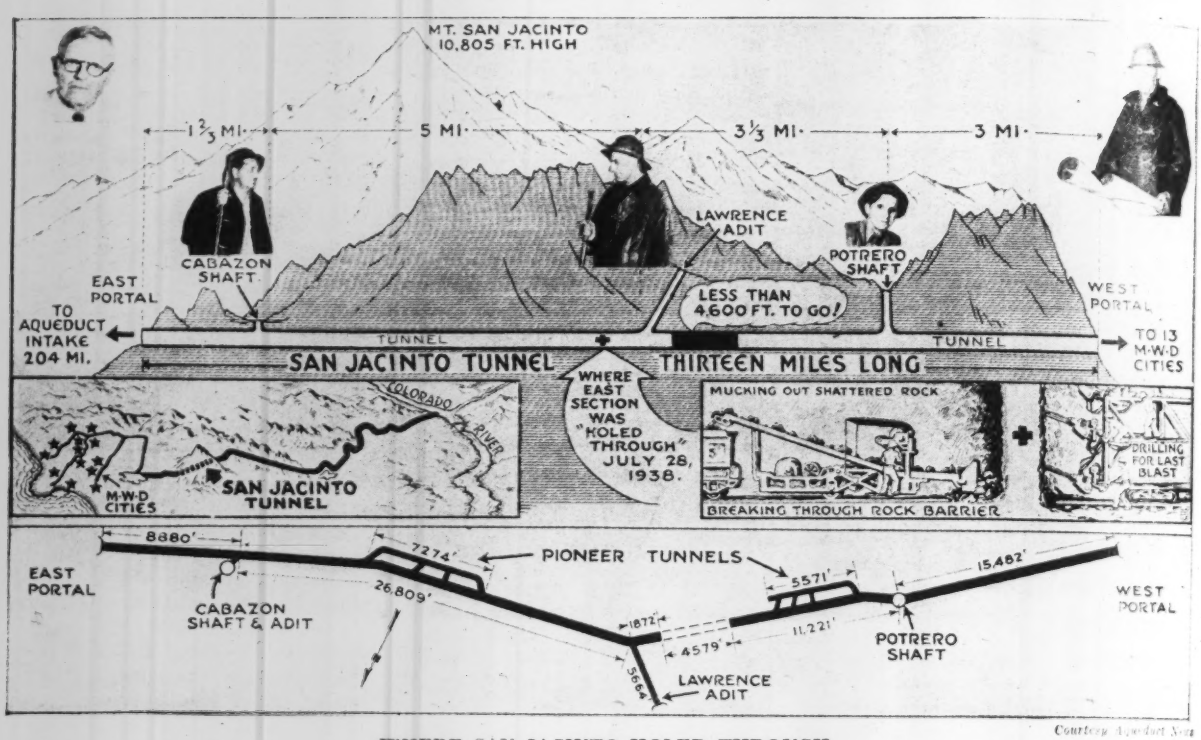
State Buildings Required To Meet Master Plan

The Washington State Supreme Court last week declared that Governor Martin has no authority to construct a new $1,000,000 building in the State House group, at a spot not specified in the "master plan" adopted by the state legislature when it appropriated $465,000 for the buildings. The "master plan" is a plan for a group of buildings around the main state capital prepared in 1911. Units in the plan yet to be built include two office buildings and a Governor's mansion.



Courtesy Aqueduct News

WHERE SAN JACINTO HOLED THROUGH

LOCATION of the holing through of a major section of the San Jacinto Tunnel of the Colorado Aqueduct (*ENR* Aug. 4, 1938, p. 125), is graphically illustrated above. Spotted in their respective camps, from left to right are superintendents C. E. Sides, John Austin, and Jack Shrode; former division engineer J. B. Bond is shown in the upper left corner, and General Superintendent B. C. Leadbetter in the upper right.

During the twelve months preceding Aug. 15, 1938, progress on the San Jacinto Tunnel totaled 16,234 ft.

BRIEF NEWS

NEW COMMERCIAL, industrial or official structures, according to a regulation of the Paris municipal council, must have roofs of non-combustible material, the top floor must be strong enough to withstand the impact of a 22-lb. bomb, and the lowest floor must be designed to carry the weight of the entire structure in the event of its collapse. In addition, bomb-proof shelters, large enough to accommodate 150 persons, must be provided.

ACTIVE ADMINISTRATION of the Natural Gas Act, passed at the last session of Congress, was begun by the Federal Power Commission last July. The commission instituted an investigation of natural gas companies, directing all firms in the industry to fill out and return a questionnaire; established provisional rules of practice and regulations; and ordered natural gas companies to file schedules of rates and charges.

LICENSE for a hydro-electric project on the Des Moines River near Hinsdale, Iowa, is being sought from the Federal Power Commission by the Curtis Power & Light Co. of Keokuk, Iowa. The proposed project would consist of a low dam and a power house containing four generator units with a total capacity of 10,400 horsepower at 12 foot of head.

THE CONSULTING business of the late Homer G. Balcom will be continued under the name of H. G. Balcom Associates by his surviving partners.

THE EXPORT-IMPORT BANK has arranged to facilitate construction for the Haitian government of a three or four year program of public works by the J. G. White Engineering Corp. of New York City. The bank will discount notes issued to the White corporation by the government of Haiti.

A NEW PERMIT has been granted to the Delaware River Tunnel Corp. to construct a vehicle tunnel under the Delaware River between Mantua Creek, N. J., and Hog Island, Pa., by the Pennsylvania Public Utility Commission. The new permit, in effect, renews a previous permit issued in 1936. So far it has not proved possible to finance the project.

Contractor Seeks Damages For Ground Condition

The Montreal contracting firm of Paradis & Farley has brought suit against the Canadian department of public works for damages of $160,000, alleging that ground conditions on a wharf construction job at Rimouski Harbor were not as represented on the contract drawings.

The work involved driving of heavy steel sheet piling. Paradis & Farley were awarded the contract late in 1936 on their low bid of $366,000. This bid was about $67,000 below the higher estimate of the department of public works.

The contractors state that during the pile driving "a large number of boulders were encountered which were not expected" and that "most of the material encountered was hardpan, dry and in its natural state and devoid of lubricating properties". They claim that the borings shown on the contract drawings indicated the presence of clay, and they characterized the contract drawings as "misleading and representing conditions very different from those actually encountered".

Fence Manufacturers Told To Stop Price-Fixing

The Federal Trade Commission last month issued an order directing the members of the United Fence Manufacturers Association, of Burlington, N. J., to discontinue combining in the quotation of identical delivered prices on snow fence, to cease fixing and maintaining uniform prices and discounts, and to discontinue operation of any agreement tending to suppress price competition.

The commission has also ordered Lumino Co. of New York to discontinue representing that Lumino renders concrete or masonry walls or structures impervious to water or dampness.

A complaint, charging violation of the Federal Trade Commission Act have been issued against Devoe & Reynolds Co. of New York, alleging misrepresentation of the efficacy of their paints.

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Tile Manufacturers Accused Of Price Discrimination

Price discrimination in the sale of tile as between contractors and "certain customers designated as wholesalers" but who "are in fact retailers" was charged by the Federal Trade Commission in complaints issued last month against eight manufacturers of tile.

All of the companies named, according to the complaints, allowed discounts varying from 5 to 15 per cent to customers designated as wholesalers, but did not allow these discounts to other customers designated as contractors. According to the commission, these wholesalers are in fact, retailers in that they sell directly or indirectly to the ultimate consumer and thereby are in direct competition with the contractors in the sale of tile.

Three of the companies, Trent Tile Co., Trenton, N. J.: Architectural Tiling Co., Keyport, N. J., and National Tile Co., Anderson, Ind., are alleged also to discriminate in price between different contractors, by giving to some varying discounts which are not granted to others.

The other companies named in the complaint are: Superior Ceramics Corp., Anderson, Ind.: Mosaic Tile Co., Zanesville, Ohio: C. Pardee Works, Perth Amboy, N. J., and Matawan Tile Co., of Matawan, N. J., and their jointly owned distributing agency, Pardee-Matawan Tile Company: Wenczel Tile Co., Trenton: and Wheeling Tile Co., Wheeling, W. Va.

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Connecticut May Build Parkway Gas Stations

The state highway department of Connecticut may legally build gas stations along the Merritt Parkway and lease them to private operators, according to a ruling of Assistant Attorney General R. F. Corkey.

Corkey's finding is based on a section of the law permitting the state highway commissioner to "erect either temporary or permanent buildings on land owned by the state and under jurisdiction of the state highway department for purposes incidental to the construction and maintenance of highways." Since the new parkway is so laid out as to prevent access to private stations, Corkey points out, stations built by the state can properly be classified as "for purposes incidental to the construction and maintenance of highways" and are therefore legally built.

LABOR NOTES

SHASTA DAM will be built by AFL workmen under the terms of a closed shop agreement, signed by Pacific Constructors, Inc., the contractors on the dam. Pacific Constructors signed with 14 international unions affiliated to the California State Federation of Labor.

THE B. & M. CONSTRUCTION CO. has signed a closed shop agreement with the AFL electrical workers union on construction of a power line at the Grand River Dam in Oklahoma.

WORK WAS RESUMED Aug. 17 on a building project of the Pennsylvania General State Authority at State College, Pa., after a four-day strike of the Operators, Plasterers and Cement Finishers Union. The strike began when a new wage scale, reduced from $1.25 to $1.00 an hour was announced. Work was resumed with the men receiving the higher rate under an agreement by which they were to reimburse the contractor, McClosky & Co., if arbitrators set the lower figure.

STATE BUILDING PROJECTS also suffered a brief strike at Jefferson City, Mo., where AFL building trades workers walked out Aug. 15. On Aug. 18 the Jefferson City Building Trades Council elected a new president and voted to resume work on all the state buildings except a prison project. The strikers went back to work on Aug. 22. The strike was called in protest against granting of an injunction preventing A.F.L. unions from interfering with erection of certain steel work by employees of the Chicago Bridge & Iron Co., who are in an independent union.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY ENGINEERING NEWS-RECORD IN AUGUST, 1938

Engineering News-Record *reports projects of the following minimum costs: Waterworks, excavation, drainage and irrigation, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.*

Four Weeks — Thousands of Dollars (000 Omitted)

							United States			
							August	Eight Months		
Public Works	**New England**	**Middle Atlantic**	**South**	**Mid West**	**West of Mississippi**	**Far West**	**1938**	**1938**	**1937**	**Canada**
Waterworks	346	21,898	363	436	943	427	**24,413**	74,258	49,769	194
Sewerage	2,208	3,240	69	2,215	329	716	**8,777**	68,440	64,998	223
Bridges, public	67	3,768	1,339	5,634	5,745	1,020	**17,573**	68,352	81,805	110
Earthwork and waterways	626	4,777	3,022	1,550	10,036	7,156	**27,167**	192,193	71,667	888
Streets and roads	3,337	7,156	11,978	7,535	18,616	8,390	**57,012**	397,111	273,749	1,378
Buildings, public	3,835	4,232	6,470	3,905	4,676	3,193	**26,311**	210,370	219,049	1,217
Unclassified, public	436	5,434	951	1,767	2,625	13,499	**24,712**	115,438	104,602	339
Total public	**10,855**	**50,505**	**24,192**	**23,042**	**42,970**	**34,401**	**185,965**	**1,126,162**	**865,639**	**4,558**
Federal government (included in above classifications)	1,412	5,712	8,392	2,361	9,119	23,075	**50,071**	225,221	134,332	.....
Private										
Bridges, private	.....	.....	.....	20	25	.....	**45**	4,593	5,841	.....
Buildings, industrial	1,090	4,545	2,125	745	393	1,054	**9,952**	105,453	372,394	995
Buildings, commercial	2,330	24,445	1,000	1,850	5,754	1,281	**36,660**	419,859	310,589	700
Unclassified, private	225	145	409	157	2,468	245	**3,649**	58,477	121,034	.....
Total private	**3,645**	**29,135**	**3,534**	**2,772**	**8,640**	**2,580**	**50,306**	**588,373**	**809,858**	**1,695**
Total Engineering Construction										
August, 1938 (4 weeks)	**14,500**	**79,640**	**27,726**	**25,814**	**51,610**	**36,981**	**236,271**	.....	.....	**6,253**
July, 1938 (4 weeks)	8,517	63,565	15,201	32,925	33,777	69,408	**223,333**	.....	.....	10,064
August, 1937 (4 weeks)	9,352	51,649	21,066	36,451	26,739	24,811	**170,058**	.....	.....	20,805
Eight months, 1938	78,422	682,086	166,705	209,283	299,622	278,417	.....	1,714,535	.....	57,264
Eight months, 1937	79,979	761,350	162,127	269,755	232,207	170,078	.....	.....	1,675,497	93,596

CONTRACTS AND CAPITAL

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . FHA MORTGAGES

(,000 omitted)	August 1937 (4 wks.)	August 1938 (4 wks.)	% Change	Eight Months 1937 (34 wks.)	Eight Months 1938 (34 wks.)	% Change
Total Construction Volume	$170,068	$236,271	+39.0	$1,675,497	$1,714,535	+2.3
Private	66,419	50,306	−24.0	809,858	588,373	−27.0
Public	103,649	185,965	+79.5	865,639	1,126,162	+30.0
Federal	19,794	50,071	+153.0	134,332	225,221	+68.0
Total New Productive Capital	$108,166	$251,457	−38.0	$1,325,983	$2,738,859	+107.0
Private Investment	92,302	67,387	−27.0	768,088	650,547	−15.0
Federal (non-Federal work)	54,864	190,308	+247.0	296,838	944,370	+218.0
Federal (Federal work)	261,000	−6,238	.....	261,057	1,143,942	+338.0
FHA Mortgages Selected for Appraisal	$48,310	$90,038*	+87.0	$429,641	$638,422*	+49.0

* *Preliminary totals.*

CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

	September 1937	September 1938	% Change	Change August to September 1937 Aug.	1937 Sept.	1937 %	Change August to September 1938 Aug.	1938 Sept.	1938 %
ENR Construction Cost Index, 1913=100	241.62	232.70	−3.6	240.65	241.62	+0.4	232.39	232.70	+0.1
ENR Building Cost Index, 1913=100	200.62	194.80	−3.0	200.65	200.62	0	194.49	194.80	+0.2
***ENR* 20-CITIES' AVERAGE**									
Common Labor	$0.673	$0.677	+0.6	$0.668	$0.673	+0.7	$0.677	$0.677	0
Skilled Labor (Av. 3 Trades)	1.369	1.426	+4.2	1.369	1.369	0	1.426	1.426	0
Bricklayers	1.459	1.519	+4.1	1.459	1.459	0	1.519	1.519	0
Struct. Ironworkers	1.413	1.473	+4.2	1.413	1.413	0	1.473	1.473	0
Carpenters	1.235	1.288	+4.3	1.235	1.235	0	1.288	1.288	0
Cement, per bbl	$2.53	$2.57	+1.6	$2.54	$2.53	−0.4	$2.58	$2.57	−0.4
Reinforcing Steel, Pittsburgh	2.55	2.05	−19.6	2.55	2.55	0	2.05	2.05	0
Struct. Steel Shapes, Pitts.	2.25	2.10	−6.7	2.25	2.25	0	2.10	2.10	0
Sand, per ton	1.16	1.24	+6.9	1.16	1.16	0	1.24	1.24	0
Lumber, 2x4 Fir, per M ft.	37.23	31.49	−15.4	37.42	37.23	−0.5	31.24	31.49	+0.8
Lumber, 2x4 Pine, per M ft.	32.93	28.15	−14.5	32.84	32.93	+0.3	27.88	28.15	+1.0
Brick, common, per M	14.33	13.86	−3.3	14.27	14.33	+0.4	13.86	13.86	0
Ready-mixed Concrete, c. y.	7.38	7.12	−3.5	7.37	7.38	+0.1	7.14	7.12	−0.3
Struct. Clay Tile, 3x12x12	72.85	74.24	+2.0	72.85	72.85	0	74.24	74.24	0
Paving Asphalt, cars, ton	17.15	15.44	−10.00	17.31	17.15	−0.9	15.38	15.44	+0.4

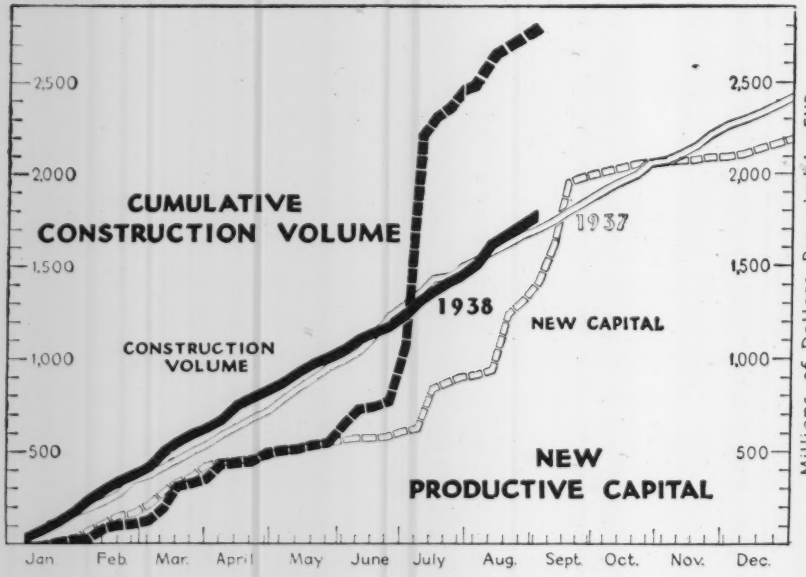
MATERIAL SHIPMENTS . . . BUILDING PERMITS

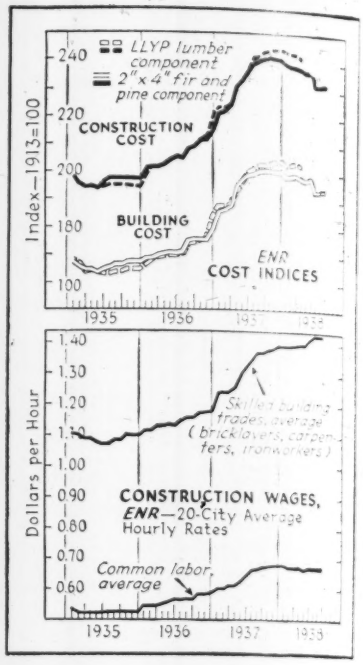
	August 1937	August 1938	% Change	July 1938	Change July-Aug.
Lumber (% 1929 wk. av.) NLMA	67.5	66.3	−1.8	55.5	+19.5
Steel (% operating capacity) AISI	84.3	40.6	−51.8	32.0	+27.0

	July 1937	July 1938	% Change	Seven Months 1937	Seven Months 1938	% Change
Fabricated Struct. Steel, (AISC) tons.	156,403	81,267	−48.0	936,459	648,522	−30.8
Cement, thous. bbl. (USB of M)	12,237	10,163	−17.1	64,775	55,749	−13.9
Building Permits, Dun & Bradstreet, (,000 omitted)	$91,334	$140,709	+54.1	$677,517	$668,269	−1.4

RENT INDEX . . . EMPLOYMENT

	July 1937	July 1938	% Change	June 1938	% Change June-July
Rent (Housing) Index, NICB	87.1	86.6	−0.6	86.7	−0.1
Trade Unions, % Employed, AFL	89.0	81.0	−9.0	81.0	0
Building Trades, % Employed, AFL	78.0	66.0	−15.4	64.0	+3.1





THIS WEEK'S FIGURES

(Thousands of dollars)

CONTRACTS

	Week Ending Sept. 2 1937	Aug. 25 1938	Sept. 1 1938
Federal	$8,535	$17,861	$8,450
State & Municipal	20,776	29,672	34,671
Total public	$29,311	$47,533	$43,121
Total private	12,314	10,374	9,161
TOTALS	$41,625	$57,907	$52,282
Cumulative 1938 (35 weeks)			$1,766,774
Cumulative 1937 (35 weeks)			$1,717,142

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	1937 35 Wk.	Cumulative 1938 35 Wk.
NON-FEDERAL	$1,174,107	$1,638,373
State & Mun. bonds	378,839	392,273
Corporate securities	409,490	271,215
PWA loans, grants	155,839	510,543
RFC loans	29,939	96,892
U.S.H.A. loans	.....	154,528
R.E.A. loans	.....	11,922
Federal Aid-Highways	200,000	201,500
FEDERAL	$261,057	$1,143,942
TOTAL CAPITAL	$1,435,164	$2,782,315

ENR INDEX NUMBERS

	Construction Cost 1913	1926	Building Cost '13	'26	Volume '13	'26
Base = 100						
Sept. 1938	232.70	111.86	194.80	105.30		
Aug. 1938	232.39	111.71	194.49	105.14	218	93
July 1938	232.29	111.66	194.39	105.08	207	81
Sept. 1937	241.62	115.85	200.62	108.53	150	55
Aug. 1937	240.65	115.65	200.65	108.55	152	57
1937 (Av.)	234.71	112.66	196.15	106.07	172	75
1936 (Av.)	206.42	99.15	172.18	93.14	185	81
1935 (Av.)	196.44	94.43	165.76	89.65	134	59

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Long Continued Vibration Reduces Concrete Strength

Sir: As part of an investigation in connection with the concrete of Lock No. 24 on the Mississippi River at Clarksville, Mo., some tests were carried out to determine the effect on concrete strength caused by prolonged vibration on successive lifts. Two shafts of concrete 6 in. in diameter by 6 ft. long were made in forms by placing standard bottomless cylinder molds on top of one another, taping the joints with adhesive tape and bracing the molds with lumber. These columns were identical in composition, all material being carefully weighed and the concrete in the two columns uniformly mixed. The concrete had a 2 in. slump.

In the first column, the concrete was placed in 1-ft. lifts and vibrated with a small internal laboratory vibrator at 9,000 r.p.m., each lift being vibrated 45 seconds. In the second column, each lift was vibrated five minutes. Both columns showed some water gain, the one vibrated for five minutes in each lift showing more than the other. Columns were stripped after 48 hours and placed in the curing tank at 70 deg. F. for 28 days, then cut into 12 in. lengths, capped and tested on the 29th day, with the following results:

Column A Vibrated 45 seconds per lift Top	Column B Vibrated 5 minutes per lift Top
6—4054 lb. sq. in.	6—3339 lb. sq. in.
5—4089 lb. sq. in.	5—3607 lb. sq. in.
4—4018 lb. sq. in.	4—4321 lb. sq. in.
3—3964 lb. sq. in.	3—4321 lb. sq. in.
2—4000 lb. sq. in.	2—3750*lb. sq. in.
1—4089 lb. sq. in.	1—4571 lb. sq. in.

*End damaged in cutting

The tests seemed to indicate that long continued vibration has a tendency to cause segregation of the materials in the concrete with a consequent weakening of the upper portion and a strengthening of the bottom portion. This difference in strength of the upper and lower portion of the same shaft is undoubtedly due to the increased water cement ratio in the upper sections and the decreased water cement ratio in the lower sections. Examination of the fractured specimens clearly showed evidence of water collecting on the underneath side of the coarse aggregate in the two top sections of column B. In surface appearance column B was actually superior to column A, showing practically no pock marks due to air bubbles trapped against the form face.

W. B. IVIE
Concrete Technician
U. S. Engineer Office, Winfield, Mo.

Everyday Concrete

Sir: Referring to the editorial on everyday concrete (*ENR*, July 13, 1938, p. 43) with reference to test cylinder strengths and the average job mix design and practice:

On a 10,000-yd. concrete job with a 3,000-lb. mix specified, I have found that our average of 28-day strengths is 42 per cent over the requirement with ranges of from 16 per cent over to 94 per cent over. For 7-day tests, in comparison to 3,000-lb. desired, the average of the cylinders was 20 per cent over, with a range of from 28 to 76 per cent over. Seven-day tests indicated strengths of 725 lb. over what should be expected. About 20 per cent of the cylinder breaks were angular, 15 per cent shear and the balance cone.

If a testing laboratory is handy, requiring little waste of time for shipping, 3-day to 7-day tests should be sufficient to determine that the mix is of the proper strength. Beam testing machines would be the only other way of securing earlier tests, assuming that they are available for the job.

Of the various methods of concrete mix design available, some simple and some complicated, none can give the satisfaction of the trial mix with its adjustments. Mixes should be designed on a basis of cement yield per yard along with the cement-water ratio. It is my experience in these days of strong ordinary cements that the yield is more important than the water-ratio. In a design by the percentage-of-voids method little equipment is needed that cannot be handily carried in the field. In no case, as in the use of stone, should the proportion of sand to coarse aggregate be more than a value of 80 per cent.

Regardless of all mix design or laboratory refinements, the proper mix itself depends on what actually leaves the mixer, and that may vary to some extent. Any concrete job of any size should have a concrete inspector who should have construction "common sense" in addition to concrete knowledge. Such an inspector can keep the foreman and mixer man on the job. No matter how many times a day a sand pile is checked for moisture there will be variations. A large pile will have quite a difference in moisture from the outside to inside. Rain, heat, wind, humidity, all vary your sand piles up to 6 gal. of water or more to the yard batch. Stone must be watched for absorption. The condition of material in the hoppers in starting a pour will vary from those in the stock pile. Weighing by batcher plant is the most suitable, and the unit weights of material will not vary much. The timer and batchmeter should be reliable. Water supply must be constant and valves must not leak, causing dripping in the drums.

Any faults occurring in the above mentioned items can only be cured by a competent mixer man and inspector. Variations occurring suddenly in moisture content should be adjusted by the added mixing water immediately, without waiting for a test. It is better to keep the mixer rolling, even if the slump is more than desired, than to allow dry batches to clog up the chutes, hopper and mixer drum. Slight delays in dumping out the drum are unavoidable, and allowance must be made for a long mix. Blessed is the mixer man who has "construction sense."

A. B. WANG
Inspector, Pennsylvania R.R.
Sandusky, Ohio, Aug. 24, 1938

Bay Bridge Test Model To Be Shown at Fair

A LARGE test model of one main span and two side spans of the San Francisco-Oakland Bay Bridge is to be exhibited at the 1939 Golden Gate Exposition at San Francisco.

The model, 11.5 ft. long by 2 in. wide, will be built to a scale of 1 to 400, using metal strips for towers and trusses, single strands of wire for the cables, and piano wire for the suspender cables. The model will be loaded with miniature trucks and other apparatus.

ENGINEERING NEWS-RECORD

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Editor, F. E. SCHMITT • *Editorial Staff*, V. T. BOUGHTON
C. S. HILL, N. A. BOWERS, W. C. BOWMAN, E. J. CLEARY
W. W. DE BERARD, H. W. RICHARDSON, R. B. COLBORN
Editorial Offices at 330 West 42nd Street, New York

SEPTEMBER 1, 1938

THE EARTH ROAD is the victim of a false association of ideas. It is commonly thought of as being nothing more than the dirt road of the days preceding automotive traffic. Even men who should know better are apt to consider the earth road as secondary, cheap, inferior. It is partly to correct these misconceptions that a series of surveys of earth road building in the South, where natural and economic conditions have encouraged high development, is begun in this issue. But the importance of these records is greater; they exemplify practical accomplishment in utilizing research in soil mechanics. They help to strip the cloak of mystery from the new science and reveal it for what it really is, a practical aid to engineering design and construction. While the articles will show that much remains to be learned, they give abundant proof of the ability of modern engineering to mold intricate lessons of research to its purposes as a builder.

Cheaper Disposal

REVIVED INTEREST in land deposition of refuse may be expected to follow on New York's success in operating several demonstration areas where so-called "land fills" are being made. The financial result of a year's trial, a saving of 75 per cent over disposal by incineration, is attention-compelling, and there is further gain in the reclamation of otherwise unusable land. These facts cannot fail to be attractive. Deposition of refuse on land is not new, of course, and everyone is familiar with the smelly garbage dump that disfigures and burdens many communities. That properly managed refuse dumping can be carried on without offense to either health or esthetics deserves to be equally well known. It is exemplified by the "sanitary fill" practice of San Francisco (ENR, Feb. 27, 1936, p. 314) and Fresno (ENR, Apr. 25, 1935, p. 593), the "controlled tipping" carried on by a number of cities in England, and now the land fills in New York. The latest demonstration particularly is of wide interest, for every city has a refuse disposal problem; and, while high-temperature incineration is perhaps the ideal disposal for garbage and combustible material, not all cities can afford it. A study of New York's experience should prove profitable to municipal officials regardless of the size or status of their community.

A Goal Achieved

DEDICATION exercises on Aug. 31 at the formal opening of Cleveland's Easterly sewage treatment plant brought to culmination the work of a quarter century in that city toward abatement of Lake Erie pollution. Following the adoption of a long-range plan in 1912, a start was made in sewage disposal, and later the works were extended in successive stages as the execution of the plan progressed and as the city grew. In 1930 public approval was given for construction of the last major unit—the 123 m.g.d. activated sludge plant in the Easterly District (see p. 250). Few cities can lay claim to more thoughtful and consistent development of sanitary facilities—a development based on a sound plan wherein all elements were integrated toward the accomplishment of a definite goal. As a result of comprehensive planning and resolute adherence to the program, Cleveland today can boast of disposal facilities which are as complete as modern practice permits.

A New Field

ANYONE WHO HAS LIVED in an apartment house knows that acoustics is a building design element that is universally ignored. Engineers know that not only is acoustical design ignored but that, on the whole, it is unmastered. Only on the staffs of the manufacturers of acoustical materials and in the offices of a handful of specialists connected with the radio and motion picture industries can it be said that well-informed talent exists. Not for long can such a condition continue, for the results achieved by acoustical experts in auditoriums, theatres, radio studios and small offices are educating the public to the value of sound control. A demand is being built up for proper acoustics as it was for properly comfortable windbracing, for air-conditioning and for scientific lighting. This means a new field of work for engineers and architects, which they should be quick to embrace. An insight into what may be demanded of them was given in an article in the Aug. 18 issue on studio construction for the motion picture industry. Not only are surfaces treated with acoustical materials but the structure of walls, roofs and floors is involved. Frames must be isolated at the same time that enclosures are insulated. Materials must be classified according to sound absorption and transmission values. Acoustical control is a new science involving new terms, new methods, new approaches to structural framing. Mastering its intricacies and taking part in its future development offers an unusual opportunity.

Notable Construction Reform

WHAT HAS BEEN accomplished in the building industry of Great Britain presents some exceedingly important lessons to the construction industry of the United States. Over there they have dealt aggressively and constructively with certain notoriously neglected problems of security, and at the same time are on the point of achieving an integrated organization of the major construction interests. This setup when in working form should make possible coherent and harmonious central action on internal problems, and also give the industry the weight and representative character necessary for effective dealing with government and public. These are things which we have not yet been able to do.

MODELS SET by British practice are not always directly applicable here, it will be said, and the remark is particularly pertinent to matters of construction and building. The habits and traditions of the two peoples differ in many ways, and of course mileage and acreage also affect the matter; there are fewer differences in climate, temperament and economic factors than in our much larger country. But conceding these and other disparities, no one who knows construction will fail to acknowledge the value of the solid accomplishment reported by Edward J. Mehren this week.

In particular the wage-grading plan and the "exceptional wage" system for building are solutions of two major difficulties surrounding construction labor—the geographical wage factor and the problem of providing compensatory pay for work of special difficulty and for emergency conditions. When disputes arising from these sources can be eliminated, a result is accomplished that is worth much to builder, to craftsman, and to consumer, i.e. the public. So also the plan of partial wet-weather payments is a significant gain. It deserves special notice as a step toward safeguarding the craftsman against a risk which he cannot control and which he ought not to bear.

MANY OTHER unfavorable conditions and risks affect construction, and therefore the three measures referred to must in due course be supplemented by many others before we can have proper stability, security and economy in construction. But even to have made a beginning in working toward these ends is a great achievement, and the British building industry deserves to be congratulated on what is has done. Such achievements were made possible only through direct organization, of course. The British system of countrywide building-trades-union centralization and the corresponding centralization of building trades employers have no parallels in the United States, whether in building alone or in the broader field of general construction. It is plain from the results, however, that we must in time build up a working equivalent of such organizations, and that until we do so we are not likely to realize even the initial results already achieved across the water.

WE HAVE MUCH REASON to look for ways of bettering and stabilizing human relations in construction. The intermittent and casual nature of construction employment both impairs the worker's security and increases the cost of the product. Jurisdictional disputes and the attendant battles between craft unions are a source of serious loss and tend to discourage demand for construction. Oppressive and fantastic working rules add further losses and frequently stand in the way of technologic progress; but since they are in part at least an attempted defense against the stranding of individual crafts, this risk must be considered before the evil of bad working rules can be fully eliminated. Construction is further hampered by many local labor requirements, both through union demands and through legislation—a quite unnecessary burden and an obstable to the attainment of continuity of employment. In short many existing practices are harmful to both worker and contractor, lower the efficiency of construction, and reduce the market demand. They need to be corrected by cooperative action.

AN IMPORTANT PART of the British system, still in the formative stage, is the broad unification of building interests represented by the Building Industries National Council. This joint council represents an ultimate goal that construction in the United States must continue to seek, in spite of past discouragement and failure. The possibilities of such central organization for reform both within the industry and between industry and government are too large to be ignored, and no other way has yet appeared—and we believe no other way is conceivable—to reach the same ends.

As a matter of fact the fundamental motive that five or six years ago inspired Robert D. Kohn and kindred spirits in the founding of the Construction League of the United States was closely the same as that of the Building Industries National Council in England. The League was unable to gain strength enough to reach its objectives. Nevertheless, whether its original plan of organization can be followed or whether another scheme will have to be devised, the prominent fact remains that central organization of the construction industry is indispensable to progress. Until such organization is accomplished there is little hope of doing away with the burdens and handicaps that help to depress the industry today.

PICTURES IN THE NEWS

Bureau of Reclamation Photo

OUTPOST FOR THE ALL-AMERICAN CANAL. Before the muddy waters of the Colorado can pass Imperial Dam's headgates into the desilting works on their way to Imperial and Coachella valleys, they must give up their debris at this unusually long trash rack. The California shore of the river is in the background, and the dam, which was finished July 30, is behind the cameraman.

LIMEROCK, THE MOST DISTINCTIVE EARTH ROAD MATERIAL OF THE SOUTH

Earth Roads in the South

C. S. HILL

Associate Editor, *Engineering News-Record*

Introduction

A high-spot survey of road soils and of how they are processed for the South's great network of modern earth roads.

THE most interesting development of modern road-building is the use of earth for roads. Dirt roads? Not at all? Earth scientifically combined and processed until it is a stable and enduringly smooth path for motor vehicle travel. Secondary roads? Largely, but by no means entirely, large mileages of main roads are earth. They are low-cost roads always; the kind that must serve most of this country's area for years to come.

Today these new earth roads are about everywhere but one goes particularly to the great plains and mountain states west of the Mississippi River or to the coastal states of the South to find them predominant. The writer went to the South. This and five following articles are a brief outline of what he learned about earth roads in the South during a month's road travel in six southern states.

Selection of this locale for field study had a definite purpose. The six southern states bordering on the Atlantic and Gulf coasts have constituted themselves by practice a laboratory of earth road experimentation in the East. This has come about logically. All these states must struggle with a little money per mile of road to meet a pressing demand for increased mileages of improved roads; in all, earth roads are the only possible means of meeting large mileage demands. The topography of the states is similar: A coastal plain and (except in Florida) Piedmont highlands backed by mountains. The roadbuilding soils are alike: Sands along the coast, sand-clay and gravel-clay mixtures in the Piedmont and rock and stream float in the mountains. Opportunities for comparison of thinking and practice in the use of earth for roads are therefore large.

But a brief survey showed that while striking differences existed, the similarities were far more noticeable. For example, the common earth road structure of the south is a stabilized-soil base on a designed subgrade and topped with a bituminous surface treatment. There are other construction types of course, but the surface-

treated stabilized-soil base prevails. With types of soils very much alike, as just stated, construction processes have become similar. Obviously, saying over the same thing for each state served no purpose and to avoid a repetition and yet omit no essential element of earth road construction in the South, the articles are as follows:

In each some one phase or practice of earth roadbuilding is emphasized as follows: Virginia, system development; Florida, limerock and sand-bituminous bases; Alabama, surface treatment and natural soil stabilization; Georgia, base soil types and base construction; South Carolina, soil processing with tar and cement; North Carolina, sand-asphalt bases and surfaces and plant-mix construction. Together the articles survey the elements of earth roadbuilding in the South, but they are in no way a manual for earth roadbuilders.

Any handbook of specific directions would be a large volume. Contrary perhaps to common opinion the earth road as considered here is not a simple structure. It involves all the scientific knowledge that is had of the two most complex roadbuilding materials used—the soils of the earth and the bitumins. This sounds formidable and it is, but it is one of the interesting features of the following articles that they show how well road engineers have wrought these complex materials to the purposes of cheaper road service.

A final word of explanation must be one of thanks to the engineer heads of southern states highway departments and their engineering staffs who forwarded the editor's field observations and answered his many questions. Such interest as is found in the articles that follow is due to this fine cooperation.

Virginia

Virginia has improved and consolidated the miscellany of roads in 97 counties into a mapped and inventoried state secondary system

VIRGINIA offers an earth road problem as individualistic as the Old Dominion itself, it is building an *earth road system*. Outside of this system the state is not carrying out any distinctly characteristic earth road development; its primary road system is made up of higher types. The earth road system is what was in 1931 the network of county roads, then about 34,000 mi. long, but now 37,000 mi., all beautifully mapped and marked and half of the mileage greatly improved. It came about this way.

Wrapping up 34,000 mi. of county roads in a bundle six years ago, the Virginia legislature handed it to the state highway commission with the injunction to take care of it. To pay for the additional work, the legislature said, "the commission can have the 1½c. of the state gasoline tax that heretofore we have been giving to the counties." That was the limit of legislative generosity. And so with 9,000 mi. of state primary road on its hands, the commission took on its new task. It started quickly, organized well and has accomplished a lot of work. A secondary system of all-weather highways is emerging

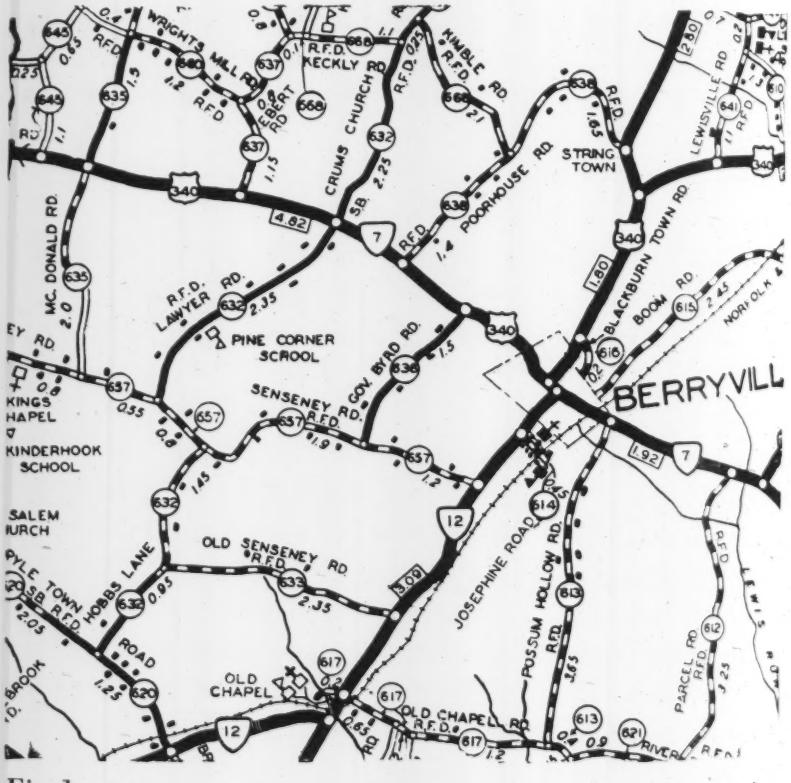

Fig. 1. A fraction of a county road map; every county is separately mapped to show every road, stream, schoolhouse, church and prominent landmark by name or number.

Fig. 2. On 30-ft. right of way Virginia is earth-surfacing hundreds of miles to carry motor vehicles.

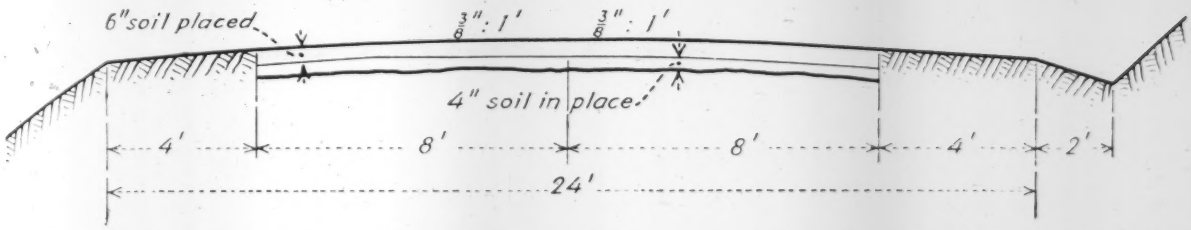

Fig. 3. A typical section of a Virginia secondary system road with a surface treated stabilized earth base; this section is fitted to the prevailing 30-ft. right of way of the old county roads.

from an aggregation of county roads that ranged from trails upward through all the earth types to surface-treated bases. The story of this secondary system genesis and development stands out foremost in the impressions that a road wanderer gets of earth road activities in Virginia. It also is significant in face of the indicated trend everywhere to transfer the control of local roads to the state.

What the law provided

Of course Virginia was not tne first state to make all roads state roads. North Carolina had antedated it by a year and Pennsylvania and Louisiana had legislated large blocks (20,000 mi. and 6,000 mi. respectively) of local roads into state-system roads, but these states had not made control all-inclusive. Only North Carolina had gone all the way in state road control. Did the example of North Carolina legislation encourage legislative action in Virginia? Probably it did but probably also it was local tax relief that was impelling.

Anyway during the last days of the Virginia legislature of 1932, an act was passed establishing a secondary road system, requiring the state highway commission to take over all county roads maintained by the various boards of supervisors as of July 1, 1932. This act further provided that the people of any county could take vote whether they wished to stay in the plan or to vote out. At the election, in August (1932) 96 of the state's 100 counties voted to come into the plan; during the year 1933-34 another county voted in, leaving only three counties outside of the plan; these were Arlington, Warwick and Henrico, all having taxables that gave them a local road income larger than the sum they could expect under the state plan; probably also sentiment for local control played a part in the choice to remain independent.

The law abrogated all county road taxes after July 1, 1932, except such as might be assessed to pay old road debts; the state assumed none of these. In brief the counties remained responsible for all highway commitments prior to July 1, 1932; could assume no obligations for road work after that date; lost their share of the state gas tax, and relinquished all control of their roads except in public hearing with the state to recommend yearly improvement programs and added new road mileage. The state was to observe the local recommendations as far as its system planning and funds available permitted. The law provided that all roadbuilding equipment could be sold to the state at an agreed price, could be donated to the state or could be marketed otherwise, any money received to be applied first to back county-highway obligations.

It is estimated that the law relieved the counties of about $8,000,000 in road taxes. Apparently this was the controlling motive for its enactment. Parenthetically one slip

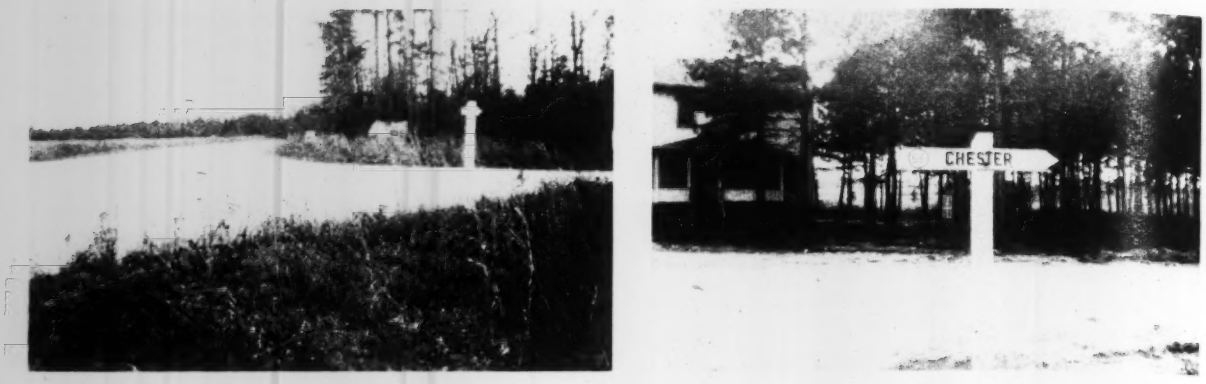

Fig. 4. A sign post carries the road numbers at every intersection. Where secondary roads intersect (left) the sign carries the road number only but where a main road is met (right) the name and direction of the nearest town are also indicated.

was made; it was apparently overlooked that the railroads came in on the new deal; naturally no such favor was intended and the regrets of the counties have been furious. But the railways went for the law lock, stock and barrel and it went through whooping. The state of course got back the 1½c. gas tax that previously went to the counties but no other funds. It took on the construction and maintenance as of 1932 of about 34,000 mi. of secondary-system highway besides its about 9,000 mi. of primary road.

Action was prompt

Sensing the certainty of legislation the state highway department began to organize for action even before the actual enaction of the law. By July 1, 1932, the department was ready to take over. Engineers at once took the field and inspection was begun of every mile of secondary-system road. A sketch map was drawn showing every house in sight of the road, rural free delivery and school bus routes, bridges, condition and type of surface, names of crossing streams, distances between points of intersection and other data. These data were worked up on a map for each county as of July 1, 1932; these maps have since been revised about every two years. (Fig. 1.) Along with the road survey an inventory was made of all the county equipment, it was valued and a purchase price agreed on. Incidentally the appraised value was about 50 per cent of the original cost.

The next action was the allocation of funds. The law required (1) that in each county should be expended an equal amount to its 1931 gas tax and (2) that of state funds not less than $2,000,000 a year be allocated to secondary system work in counties as the state might deem reasonable and necessary. The first procedure was to set down in a column opposite each county the amount of its 1931 gas tax money; then in a parallel column was set down each county's actual road expenditure averaged for four years, 1927-30. It was decided to be liberal (above $2,000,000) in state money allotment so that for each of the six years the state allotment has been nearly $3,500,000 making the total, with gas tax, about $6,000,000 every year.

Building by maintenance

It was decided to place the secondary road work under the state maintenance department because (1) it already had statewide coverage the year around and (2) the work was maintenance or building up by maintenance. Force account was decided on for reason (2) above and also because projects were small, of many kinds and covered 97 counties. The only variation is where secondary-road federal-aid money is used and here the B.P.R. requires contract construction. Under the maintenance engineer the work is done by eight district engineers each with a force of resident engineers. Common maintenance is by patrol, special maintenance is by floating crews and construction is by special force organized and equipped for the project.

A patrol unit consists of a patrolman and a helper and it averages 50 mi. of road. Its regular equipment is a 1½-ton truck, a small road machine hauled by the truck, a rubber-tired, oil-burning heating kettle (210-gal.) with pump, nozzles, etc.; a tamper, and small tools. The patrol units also do routine maintenance on primary roads. Each has a shelter for equipment and each can hire extra men as occasion requires.

In a few of the larger counties four or five patrol units have been combined into a single unit with one foreman or superintendent in charge. When dragging, machining or other lighter operations are necessary, the trucks are assigned a certain mileage or area to handle. When these lighter operations are not necessary during dry weather, the forces work as a gang and do construction or other heavy work. This system has advantages in that the resident engineer has less traveling with fewer men to see, to supervise the work, and heavier work can be performed without depending on a floating gang. Where this system is in effect, more local materials are being applied to the roads because with the trucks working in a gang more efficiency is secured than when they work singly. In addition to the trucks, a large tractor, and where stone is available, a crusher, are a part of the equipment.

It is not intended to convey the idea that the patrol system is not efficient. The patrol system is most efficient where the volume of materials to be handled is small and where the roads are already fairly well surfaced.

The maintenance practice is constantly to build up the road but where something approaching real reconstruction is undertaken it is a special crew operation. All work ex-

SUMMARY OF WORK COMPLETED ON VIRGINIA'S SECONDARY HIGHWAY SYSTEM AS OF NOVEMBER 16, 1937

Type of work	1932–33	1933–34	1934–35	1935–36	1936–37	Total
Constructed, conditioned or graded, Mi	6,786.89	2,324.60	2,749.70	2,365.97	1,691.27	15,918.43
Surfaced or resurfaced with local matl.— Mi	5,674.42	2,658.36	3,113.66	3,246.15	2,010.96	16,703.55
Surfaced or resurfaced with local stone — Mi	413.59	277.71	275.50	396.34	628.93	1,992.07
New bituminous surface treatment — Mi	667.62	718.75	283.44	240.74	285.56	2,196.11
Bituminous surface retreatment — Mi	208.69	336.17	598.09	623.56	1,322.66	3,089.17
Work not classed — Mi	.....	.....	.....	.....	105.98	105.98
Bridges built, new or replaced — Number	878	681	938	715	605	3,817
Bridges built, new or replaced — Ft	22,030.00	20,410.00	26,777.50	22,255.50	22,605.63	114,078.63
Bridges repaired — Number	1,037	780	871	708	654	4,050
Bridges repaired — Feet	55,763.00	39,012.00	40,671.50	30,298.30	38,171.50	203,916.30
Crushed stone — Tons	356,166.00	256,986.20	406,710.00	210,510.03	411,381.11	1,641,753.34
Local material — Loads	593,065.00	2,620,640.59	1,571,822.00	1,170,786.50	1,064,434.16	7,020,748.25
Bituminous material — Gal	6,646,835.00	6,588,941.00	4,626,973.00	4,395,898.00	6,943,374.00	29,202,021.00
Corrugated metal pipe — Ft	891,542.00	236,650.00	245,383.00	216,882.00	212,063.00	1,802,520.00
Lumber, B.M. Ft	5,441,002.00	3,940,852.00	4,010,527.00	3,762,237.00	2,669,915.90	19,824,533.90
Dynamite, Lb	492,201.00	529,503.00	552,435.00	394,267.00	497,262.00	2,465,668.00
Cement, Bbl	7,128.00	5,520.00	17,422.00	5,013.50	8,071.00	43,154.50
Funds ordinary maintenance	3,112,951.14	2,397,036.30	3,005,737.46	3,167,277.27	3,248,788.90	14,931,791.07
Total Funds Expended	$6,071,456.28	$5,817,389.90	$6,800,722.48	$6,413,977.48	$7,105,405.19	$32,208,951.33

cept federal-aid is done by day labor and with department equipment which in 1937 consisted of (count not exact) 1,300 trucks, 114 automobiles, 42 power shovels, 677 tractors, 274 mules, 1,300 road machines, 100 road rollers, 130 compressors, 200 air drills, 75 crushers, core drills and a host of small tools. The equipment investment is over $6,000,000 and between a quarter and a half million is purchased each year and about the same amount scrapped and sold. The department has a quarry and crushing plant that in 1937 produced over 100,000 tons of crushed stone. There are twelve convict camps (50 to 60 men) worked. A camp is allowed to work in a county two years, thus if the rotation is continued, each county in time will share alike. Equipment is of many makes. It is kept up in 57 residency shops (servicing work) 8 district shops (ordinary repairs) and a main shop (heavy repairs and reconstruction.)

What has been done

First what were the conditions? When the roads were taken over in July, 1932, there were 16,400 mi. unimproved, 8,600 mi. graded but unsurfaced, 8,900 top soiled or graveled or other local-material surfaced and 2,100 mi. surface treated (oil or tar). This total was from first survey and doesn't quite check with revised totals but ratios are not far off. The unimproved roads varied from mere trails to roads that a car could travel in dry weather; the others varied from poor to moderately good in each class.

The old Virginia road laws provided a 30-ft. right-of-way for highways and virtually all of the county roads had this right-of-way width; not much to build on. Where best improved, the grade was not wide and the travel surface only 14 to 16 ft. wide. In taking on the secondary roads the state has not pushed for wider right-of-way. The reason is not quite clear but apparently there are several deterrents working together. Chiefly there is need first of more all-weather mileage. With some 25,000 mi. in the mud the first task was to provide a road on top of which a car would stay. The right-of-way made possible a grade 20 to 24 ft. wide to lift travel out of the mud and this is being provided, surfaced and surface treated. Later widening and refinement will come. Incidentally the state engineers are fully aware that the present roads do not meet modern standards and will not be the final roads but as built they will be permanent parts of final roads.

Exactly what work has been accomplished? The answer involves

Fig. 5. Patching an old Virginia secondary for new surface treatment.

many items as shown in the accompanying table but broadly some $32,000,000 have been spent and about half of the present 37,000 mi. secondary system has been substantially reconstructed.

What are these roads?

In building up by maintenance a developing road system at any one time is in various stages of completion from grading to final surfacing. this situation is indicated by the accompanying table. The final structure to which improvement in Virginia is working is typified by Fig. 3. Briefly it is a grade brought to line and profile, a stabilized base course and a bituminous wearing surface. As an example take an old county road; it has bumps and hollows, jogs in alinement, sharp turns and all kinds of irregularities developed by long usage. A smooth line and profile are run, keeping within the right-of-way, to take out these irregularities, but no wide revision of line or grade is attempted. Then the grade is brought to line and profile to a width of 20 to 24 ft. This grading on a road that has remained not much more than a wagon track may be a substantial operation or, on a road that has had real engineering and construction attention, the work may not be more than some widening and reshaping of the old road grade.

Materials used

On the grade is placed a base of top soil, gravel, or crushed rock, 16 to 18 ft. wide, and this is surface treated. Ditches are dug to proper gradients; culverts and bridges are widened to 20 ft. Usually in the coastal plane the grading is earthwork and the base coarse is gravel but in the mountains there is a considerable rock work and crushed stone is used for the base course. Always the policy is to use local materials that are stable in themselves or can be made stable by adding soils that provide the element needed for stability or sometimes by processing with an artificial binder. Compared with other southern coast states, Virginia has less coastal plain (sand country) and in it are more gravels and there is a smaller economic place for the processing with binders that straight-sand country makes economic. Perhaps too the direction of engineering thinking has not turned so actively to soil processing as a substitute for soil stabilization.

After base construction the most important farm-to-market roads are roofed with a thin (surface treatment) bituminous wearing course. The base is swept clean and given a bituminous prime coat on which is spread just a cover layer of fine aggregate; after the prime has set up a second bituminous application and a heavier cover of fine aggregate are placed and rolled to compaction. Pressure distributors and mechanical aggregate spreaders are specified for this type of work.

Many miles of road that do not carry sufficient traffic to justify a bituminous surface treatment at this time are surfaced with local materials; with the funds available it would be impossible to do more. The situation may be analyzed as follows: original bituminous treatments, exclusive of the preparation of the base, costs $1,000 per mile, and will last three years, or an annual cost-spread of $333 per year. Retreatment at the end of three years at the rate of $800 per mile should last four years, or an annual cost-spread of $200 per year. This operation continued over a period of years, including ordinary maintenance costs of $75 per year, means at least a minimum annual cost of $275 per mile per year, which is more than the funds that are anticipated to be available, certainly within the near future.

Operation is stressed

Ordinarily, secondary road operation goes little beyond maintenance; Virginia has taken a further step in mapping, numbering and marking these roads. This is a definite aid in keeping upkeep and improvement records; every operation in the field is capable of precise definition in the improvement-progress and the cost-accounting records. But the mapping, marking and numbering furnish also a travel guide of exceptional character. Each county is mapped as shown by Fig. 1; with sign posts at every intersection giving the road numbers and the symbols noted; direction to travel is precise to a degree approached only by the road mapping being done by the federal-state planning surveys now in progress (*ENR*, June 2, p. 773; June 9, p. 823).

The marking scheme is shown by Fig. 4. Where a secondary road intersects a primary or truck line road a directional slat pointing to the first local point of importance on the second road is used. This slat does not carry mileage but carries, within the circle, the secondary route number. At the intersection of two secondary roads it is not attempted to direct traffic because these roads are used primarily by local people who already know which road to take, and only a very short slat carrying the route numbers of the secondary roads is erected. By numbering these routes on the map and then erecting at the various intersections the route numbers the highway engineers are able to follow the map when making inspections and when people write in regarding conditions on the road they can refer to the route number, which enables the engineer very quickly to locate the section of road referred to by the person interested.

Faster travel expected

With the development of secondary roads traffic changes have come that put greater demands on operation. As improved secondary mileages increase farmers are disposing of their horses, wagons and buggies and are buying automobiles and trucks. A demand for faster travel follows, and this calls for surfacing and more exact and costly maintenance. The lack in Virginia at the moment is increased funds to meet increasing costs.

Direction

State secondary system roads in Virginia are in charge of the state highway commission, Henry G. Shirley, commissioner, and C. S. Mullen, chief engineer. J. J. Forrer is maintenance engineer and to him the writer is indebted for many courteously-granted hours in the office and on the road furnishing the data from which this article is prepared.

Next week the scene shifts to Florida where limerock and sand-bituminous base construction marks one of the high spots in earth road practice in the South.

FIG. 1. SIMPLE LINES CHARACTERIZE THE NEW GEHRING ROAD BRIDGE

High Concrete Bridge for Low Cost

E. A. WHITE

Assistant County Engineer, Pierce County, Washington

Unusually tall columns and hollow-type construction throughout feature bridge near Tacoma, Wash., built for $84 per ft.

UNUSUALLY long columns and the use of hollow-type construction in all vertical and horizontal members, even in sidewalk sections, lend special interest to a highway bridge recently built near Tacoma, Wash., and known as the Gehring Road Bridge. The structure is 264 ft. long, 90 ft. above streambed, has a central span of 90 ft. and its 20-ft. roadway is designed for H-15 loading. The incentive in the hollow-type construction was to keep the cost within the budget. This was accomplished by a design that used permanently imbedded forms and cellular construction to such an extent that the entire structure required only 500 cu. yd. of concrete or 1.9 cu. yd. per lin. ft. It was built for $22,070 which is $83.60 per lin. ft. or $3.34 per sq. ft. of overall width.

Extending from end to end of the bridge are two hollow girders 4 ft. wide and spaced 7 ft. apart. The deck slab cantilevers 5 ft. beyond them on both sides thereby making the deck width 25 ft. At the bents the girders and their flush-framing columns are connected by hollow crossbeams or diaphragms 4 ft. wide. Except for these cross-beams there is no break in the continuity of the deck cross-section nor of deck formwork from one end of the bridge to the other. An inherent virtue of the large hollow girder is that it possesses stiffness and ability to resist transverse rotational forces, so that with proper positioning it is possible to eliminate exterior cross-diaphragms, tie beams, brackets and similar impedimenta.

At the bents at the end of the 90-ft. main span the girders are deepened 1 ft. in a distance of 10 ft. by means of flat haunches. Elsewhere their depth is uniformly 5 ft. Their side or web thickness of 8 in., is constant from one end of the bridge to the other and their bottom slabs are 5 in. thick except for the 17 in. thickness at the haunches. The main reinforcement, both positive and negative, is distributed quite uniformly across the full breadth of section. In the 90-ft. span there are 6-in. interior diaphragms in the girders at the center and at the quarter points. In the 70-ft. spans these diaphragms are placed at the third points. U-stirrups are employed in each side of the hollow girders. The bottom slab is reinforced with ½-in. rounds, 13 in. on centers, whose ends are turned up 2 ft. into the girder webs. Drain holes are provided through the 6-in. interior diaphragms.

A pair of hollow columns constitutes each bent. These columns, which frame flush with the girders of the deck, are 4-ft. square, hollowed out with inner 3-ft. octagonal forms. They are without batter and are connected at their tops by a hollow cross-beam 4 ft. wide and 6 ft. deep; their footings, which bear on cemented hardpan, are also tied together. These columns were designed integral with the girders although the middle bents are too slender to have any pronounced influence upon the girder moments. The tallest columns are 72 ft. high from top of footing to bottom of girder and thus have a slenderness ratio of 18. The net cross-section of concrete in the column is 8.54 sq.ft.

The end bents, close to the top of the ravine, are quite short and, since their columns were made the same size as those of the tall bents, they are exceedingly stiff. It is, therefore, to these end bents, 230 ft. apart, that all horizontal forces coming upon the deck are transmitted by the roadway slab acting as a horizontal beam 25 ft. deep.

Provision for expansion and contraction of a wholly hypothetical magnitude in concrete bridge decks has been responsible for large expenditures of money, the benefits of which may often be questioned. What changes of length will occur in the deck of the Gehring Road bridge are not known. If it had been built with both ends fixed it would in all probability have withstood all thermal stresses developing in it without the slightest trouble. However, it was decided that whatever longitudinal volume change did occur, should be allowed to develop freely and without restraint. The short end bent at the east end of the bridge was constructed monolithic with the deck and without provision for movement; the tall middle bents can deflect slightly without appreciable stress; at the

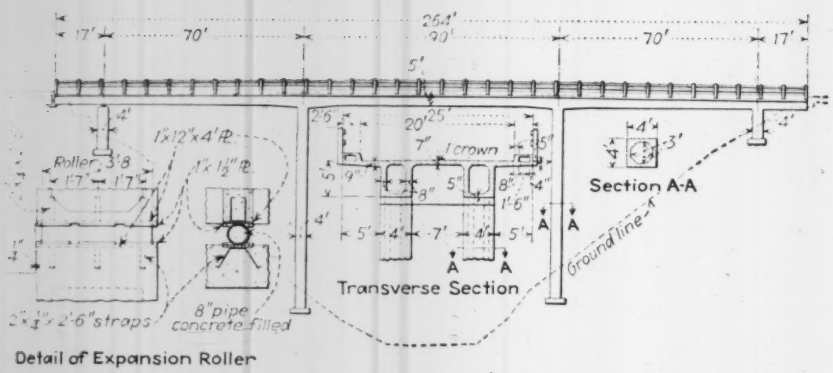

Fig. 2. Design details of a hollow-member concrete bridge of exceptional height built for an unusually low cost.

short bent at the west end rollers were provided between the girders and the columns. The deck itself is continuous and unbroken by expansion joints for its full length of 264 ft.

The columns of the bent at the free end are connected by a pair of deep, narrow beams, 6 x 48-in. in section, flush with the tops and with the outer faces of the columns. The head of each column to a depth of 18 in. is made solid. Set flush in the top of the column and in the bottom of the girder are 1 x 12-in. plates 4 ft. long, placed transverse to the longitudinal axis of the bridge. To these plates are welded 1x1½-in. marginal lug plates. Between the column and girder plates and located at the center of the columns are the rollers, which consist of 3 ft. 8-in. lengths of extra-heavy 8-in. pipe filled with concrete. Surfaces were not machined, since with a lever arm 8⅝ in. long any movements of the girder will not be seriously affected by the surface conditions on either pipe or plates.

Above the rollers the interior 12-in. diaphragms within the girders distribute stress concentrations to the side webs. These diaphragms are extended across the 7-ft. intervening space to join the two girders, and this connecting section is carried down to a depth of 12 in. below the tops of the columns, clearing the inner faces of the columns by ¼-in. gaps. If horizontal forces acting upon the bridge deck are not resisted by friction of contact between the rollers and the plates, then movement of ¼ in. and closure of the gap will bring the inner connecting web into bearing against the side of the column. In this stage it is assumed that sufficient resistance will be developed. At the fixed end the bridge carries a transverse end wall or slab against which the embankment of the road bears directly. At the free end only a small transverse header beam is provided on the bridge; the fill is held back by a small retaining wall. A 2-in. space between face of wall and end of bridge, covered by conventional steel plates and angles, provides adequate room for expansion.

Construction methods

All interior core forms were built of 2 x 4-in. wood frames covered with shiplap. At exterior corners the meeting of narrow edges of the shiplap closed the joint but made a weak point in the form that might crush if ever subjected to direct compressive stress. These cores were wet down before concreting and if they could absorb any more moisture when the fresh concrete was put around them they undoubtedly did so. Thus in a state of maximum expansion they were embedded in the concrete. Even if it is assumed that these forms later dry out and subsequently expand again after the concrete has stiffened and set, their dimensions in this later expanded condition could be no grater than immediately after the concrete was poured. Thus it is not believed that the wood forms left enclosed within the concrete ever can constitute a menace.

Fillets were provided as shown in Fig. 2 at the junction of the girder webs with the top and bottom slabs. These are quite easy to form and with the comparatively thin sections employed are regarded as an important structural detail. The wide curbs, which really are narrow sidewalks, are also hollowed with embedded wood forms.

The construction of the tall columns was performed in an unusually simple and effective manner. The footings having been poured, the two columns were formed completely for their full height on three of their four sides; the fourth side, which was left open, was the one facing the opposite column. With all vertical steel and the outer binders in position an 8-ft. section of the inner octagonal core form, boarded over on its top, was set in place, the remaining column binders were installed, and panel forms for the fourth or inter-column faces of the two columns were put in for the 8-ft. height. At these intervals of 8 ft. the column forms were braced and girted together by pairs of horizontal 2 x 8's, spiked to the vertical studding of the columns. Loose planks, laid across these pairs of girts, constituted a working platform from which both columns were concreted simultaneously in successive 8-ft. lifts, concrete being lowered from above in buckets and shoveled into the forms.

Vibrators were used to insure filling the forms effectively. As soon as one 8-ft. lift was completed, the loose planks were raised 8 ft. to the next pair of girts and the operation was repeated.

Deck forms and concreting

As much use as possible was made of the old timber bridge which the new bridge replaces. After serving as a roadway on which concrete was delivered for pouring the bents, the old deck was removed, and the trestle cut down and strengthened to serve as part of the falsework for supporting the new deck. This was an important economy in such a deep ravine. Midway between the bents of the old bridge which were 24 ft. on centers, new bents were introduced; all were thoroughly braced together and forms for the deck were built thereon.

The inner core forms for the girders and columns, were made in a level field at the west end of the bridge, from which point they were taken as needed. All steel and stirrups in the girders were put in place before the cores were brought out. Consequently reinforcement could be placed with the utmost facility since the steel men worked freely on the bottom of what was at that time a beam 4 ft. wide.

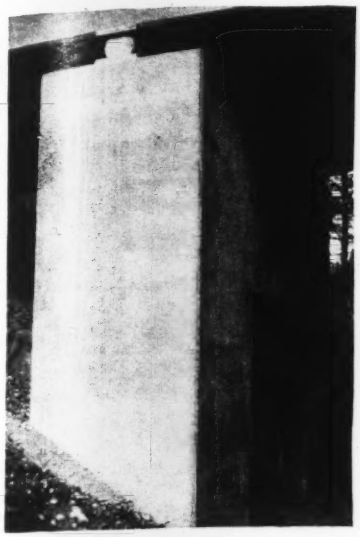

Fig. 3. Expansion of 264 ft. of bridge is concentrated at this concrete filled steel pipe roller

The deck was concreted in two operations, with a construction joint just below the fillets at the top of the girder webs. Perfect placement of the concrete in the bottom of the girders beneath the core forms was assured by dumping the concrete into the web on one side of the girder only and then using the vibrators. Under vibration plus hydrostatic head resultant from plastic concrete several feet deep, the mass was made to flow forward and across the girder bottom. Not until it started to rise in the opposite web, thus proving that the space beneath the core had been filled, was concrete dumped on that side. On stripping the forms, concrete surfaces on the bottoms of the girders and elsewhere were found to be dense, full and completely free from gravel pockets. After the deck slab was poured construction of the wide hollow curbs and wood railings was the final work before the final cleanup.

On removal of falsework the deflection at the center of the 90-ft. span was only a net $\frac{3}{32}$ in.

Detailed plans of the concrete design were prepared by the W. H. Witt Co. of Seattle. H. M. Hadley of the Portland Cement Association suggested the major features of the layout. F. R. Easterday is county engineer of Pierce County; the writer is assistant county engineer. Plans were checked and approved by the Washington state highway department. S. R. Gray was the contractor.

Old Tunnel Vaults Revealed by Excavation for Building

VICTOR R. BERGMAN

Godwin Construction Co., New York City

Discovery of tunneled rooms with 21-ft. flat roofs necessitates change in foundation plans for New York apartment

THE SITE of an 18-story apartment house being built at the corner of 57th St. and Sutton Place, in New York's fashionable residential area, looked innocent enough to the foundation contractor when he started excavation work, for the corner had been used for years as a tennis court, level with the sidewalk. Yet the contractor was somewhat suspicious of underground conditions, because old maps showed that long ago a brewery occupied the site. Old breweries in New York usually had some kind of underground beer vaults, yet in this instance, no records were available which showed that there had been underground storage.

General excavation of the lot was carried down to bedrock, about 14 ft. below sidewalk level, without trace of the old brewery except a layer of cobblestones dug up beneath the tennis court fill, probably the paving of the old loading yard. However, as the power shovel was making the final cleanup preparatory to the blasting of a shallow rock ridge to level off the subgrade, a gaping hole suddenly appeared ahead in apparently solid ground. Investigation revealed that an arch of earth over a small opening had collapsed into a large cavern in the rock below.

Exploration of the cavern showed that there were three connected vaults beneath the site, two of which were of unusual interest. These were rectangular chambers tunneled out of solid rock, each roughly 58 ft. long, 13 ft. high and 21 ft. wide. The rooms were parallel, separated by an 18-ft. wall of rock. The most unusual feature of each was a flat, unsupported rock roof of 21-ft. span. These two tunnels were connected by small openings to a third vault extending across one end of both rock caverns. This room had been excavated from the surface, lined with heavy stone

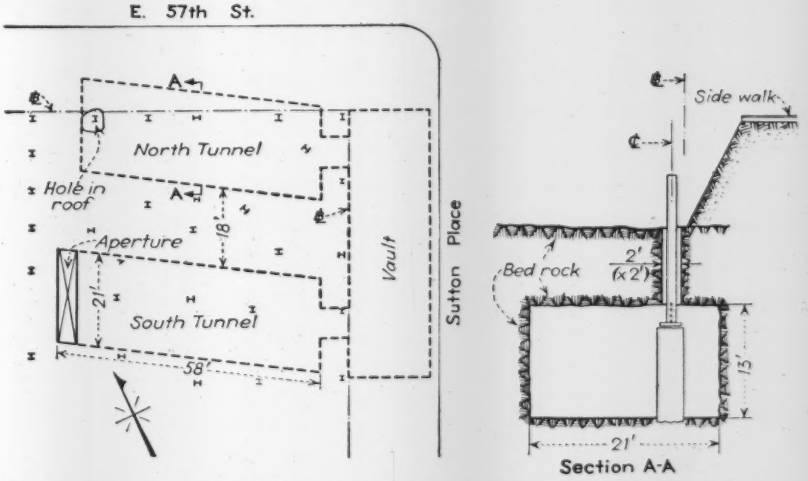

Fig. 1. The two rock tunnels were oriented to take advantage of the dip of the rock, thereby permitting flat roofs of 21-ft. span. Columns over one tunnel were carried down through the roof.

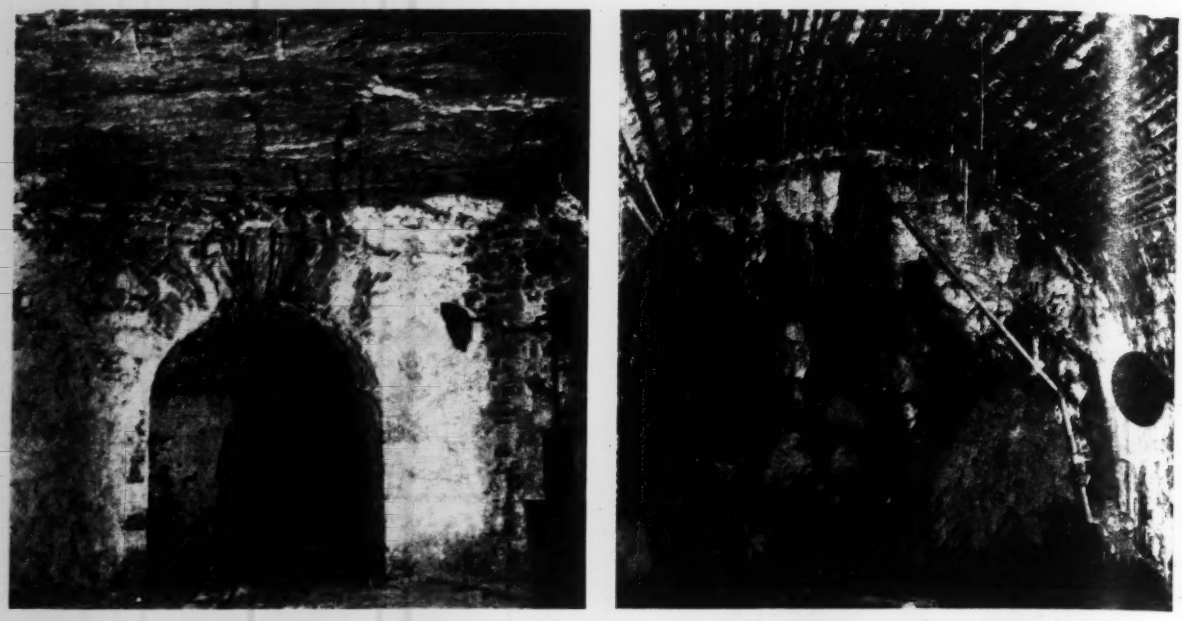

Fig. 2. Building excavation reveals old beer storage vaults. At left is one of two flat-roof chambers dug out of solid rock; the third vault (right) has a stone arch roof.

walls and covered with a stone arch roof.

The rock is Manhattan schist with numerous foliation planes dipping steeply to the west. The tunnels were not oriented square with the lot, but had been laid out on an angle and with respect to the dip of the strata to eliminate danger of a rock slide. The position of the vaults is shown in the accompanying drawings, and the photographs show the interiors of the chambers.

Change in foundation plans

Discovery of the vaults below the planned foundation level naturally required a change in foundation plans. After due consideration, it was decided to remove the roof of the southerly chamber by blasting and to carry the columns in this area down to the tunnel floor. A different procedure was adopted for the other chamber, for part of it extends out under the 57th St. sidewalk. Here the rock roof of the chamber was preserved and four columns were carried down to concrete piers on the floor through 2x2-ft. holes cut in the roof. To eliminate the need for blasting over this chamber, the subgrade was raised a few feet in elevation. For the columns along the Sutton Place building line, pier holes were cut down through the heavy stone walls of the vault to reach solid rock just below the level of the vault floor.

These vaults are the first of their kind which the contractor, the Godwin Const. Co., of New York, has encountered in over 30 years of foundation work in Manhattan.

Completion of the apartment house is scheduled for the fall of 1938. The owners, Harold D. Uris and Percy Uris, are constructing the building with plans prepared by Emery Roth & Sons, architects, and Ball & Snyder, consulting engineers.

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Plan Pollution Abatement of Big Sioux River

ON THE BASIS of a detailed stream-pollution survey of the Big Sioux River, the state board of health of South Dakota has made a number of recommendations for improving the conditions. This survey, under W. W. Towne, director of the division of sanitary engineering, extended for some 130 miles, from Flandreau, So. Dak., to Hawarden, Iowa. Of eight towns contributing sewage or waste to this stretch of the river, five (aggregating a population of 9,640) have no system of treatment. Of the others (with an aggregate of 49,200, including Sioux Falls with 33,644), the two largest have primary, secondary and final treatment, while the third and smallest had only primary and secondary treatment. The survey included stream flow measurement and chemical, biological and bacteriological analyses.

As a source of drinking water, the river is used only by the Flandreau Indian School, but the report points out that water from the river should not be used for human consumption without adequate treatment. While the river contains some fish, the survey showed that at several points the dissolved oxygen content was below the 3 p.p.m. which is the minimum required by fish life. At five bathing beaches, the conditions were fair or poor.

For any other recreational uses, the river was objectionable only below sewer or waste outlets, but during periods of low flow the conditions may reach the nuisance stage for considerable distances. For stock watering, the river is generally satisfactory, unless nuisance conditions prevail. The city of Sioux Falls has a sewage treatment plant, but may be required to chlorinate its effluent during low river flow, in order to improve the bacteriological conditions below the city.

River Measurement and Water Studies

JOHN C. HOYT

Hydraulic Engineer, U. S. Geological Survey, Washington, D. C.

Rapid increase in importance of water needs has led to expansion of river measurement to more than 3,000 stations

WATER STUDIES in the past have been based largely on theoretical considerations, with relatively few substantiating data. Technical requirements of recent years, however, have brought the need for better data into sharp relief, and in consequence the collection of adequate water data has undergone remarkable improvement.

A definite water-mindedness has developed, even in the public consciousness. The development of most sections of the country has progressed to a stage where difficulty is found in obtaining a supply of water to meet all public requirements. In addition, the severe floods of recent years focused attention on the lack of knowledge concerning maximum streamflow, especially because encroachments on river bottoms are so extensive as to make flood damages more and more serious. Correct water data are also needed in connection with the large storage reservoirs for irrigation and power, whose number has increased greatly in the last decade or two. These developments, together with navigation demands, have brought about a widespread appreciation of the need for definite facts on water. As a result of this water-mindedness, all activities connected with the collection, study and use of hydrologic and meteorologic data have enjoyed increased activity.

How the work has evolved

In view of the magnitude of the present activities relating to water, it is interesting to look back at the history of water measurements in the United States.

Collection of data on stream flow was started by the U. S. Geological Survey 50 years ago. The beginnings of the work were small, only a few thousand dollars being available per year. Today, however, the Survey expends about two million dollars annually in stream gaging service, and has become a recognized clearing house for hydrologic data. Cooperation with the Weather Bureau and various other federal agencies, as well as with states, municipalities and private organizations, further increases the amount and value of the water data collected.

Number of stations

At the end of October, 1937, there were in operation no less than 3,381 river measurement stations in the United States. Of these about three-fourths are equipped with water-stage recorders. Many other stations, now discontinued, were the site of river observations; including these abandoned gaging stations there are records available from about 7,400 stream gaging points located throughout the country.

In addition to the measurement of the flow of streams and the study of surface water supplies, the Geological Survey has for many years conducted investigations of the availability and composition of ground waters and it has also studied the dissolved and suspended matter in surface waters. The first series of meteorological observations by the federal government was begun by the Army medical department more than a century ago. The Surgeon-General by an order dated May 2, 1814, made it the duty of each hospital surgeon to keep a diary of weather. Many medical posts have continued these diaries ever since that time.

Some fifty years later the Signal Corps of the Army was required to provide for taking meteorological observations at western military stations (1870). The government's official meteorological work was carried on by the Signal Corps for a long time thereafter, under several acts of Congress which authorized the taking of observations, issuance of forecasts and warnings, maintenance of telegraph lines in isolated regions, and similar work. In 1891, however, these duties were transferred from the Signal Corps by the organic act creating the Weather Bureau, and thus were placed in the Department of Agriculture (act of Oct. 1, 1890, which became effective July 1, 1891).

Agencies collecting data

In addition to the meteorological data collected by the Weather Bureau and the river measurements made by the Geological Survey, a number of other governmental agencies are collecting and analyzing data relative to weather and water in connection with the special problems under their preview, among them the Army Engineers, Reclamation Service, Forest Service and soil Conservation Service.

The Geological Survey and the Weather Bureau are the recognized agencies set up by Congress for collecting and making available information in regard to water on a nation-wide basis. A large part of governmental studies, federal, state and local, are made in cooperation with these two agencies and they are the principal source of information for engineers and hydrologists in the investigations which they make of water resources.

Many agencies cooperate

Much interest in the work of the Geological Survey and Weather Bureau has been manifest by the water resources committee of the National Resources Committee, the section of hydrology of the American Geophysical Union, national engineering and other organizations, all of whom have called attention to the need of extending the water measurement work and bringing about a closer coordination between the several agencies which have been engaged in such studies.

Land Fills for Refuse Disposal

E. J. CLEARY
Assistant Editor, *Engineering News-Record*

New York City is perfecting a method of handling refuse which it is claimed will save the taxpayer millions of dollars

A MODERNIZED VERSION of refuse disposal on dumps, which minimizes the objectionable features heretofore associated with that method of handling waste, has been developed by the New York City Department of Sanitation. What recommends it for attention is its low cost and adaptability to many localities where refuse disposal is an expensive and troublesome problem. Called the land-fill method, and similar to the sanitary-fill scheme used in San Francisco and to "controlled tipping" practice in England, it is essentially a technique wherein garbage and refuse may be deposited on the land without offense.

Operations conducted at eight localities in New York during the last year, in which more than 6,000,000 cu.yd. of refuse were handled, have given evidence of both the practicability and economy of the scheme. Operating costs alone, it is claimed, show a saving of about 75 per cent over disposal by incineration, the method by which the city now handles almost half of its wastes. At the present rate of operation, the land fills will thus save the taxpayer about a million dollars a year. In addition, economies in collection are achieved because vehicles lose no time in discharging their load at the fill; at the incinerators, particularly those of the older type, long delays in unloading are not infrequent.

And the final point in favor of land fills is that by this method of disposal hitherto unusable swampy and low-lying areas are being converted into first-class properties. Several of the fills are being made on sites owned by the Park Department of the city which later will be developed into recreational spots.

The origin of the present technique of land fill goes back to the time, two years ago, when William F. Carey took over the duties of commissioner of sanitation. One of his first problems was to correct conditions on Rikers Island in the East River, where New York had been dumping refuse for 43 years. This 420-acre smoldering dump was the cause of bitter complaint from those living within range of its odors in nearby thickly populated Queens borough.

Under Commissioner Carey's orders, the practice of dumping refuse indiscriminately in piles alongside the track of a standard gage railway was discontinued. In its place was substituted handling by tractor-hauled 40 cu.yd. wagons with crawler treads, and dumping operations were confined to small areas which could be covered and sealed with ashes every few days. Aside from their mobility, the tractor wagons offered another advantage—because of their weight and the wide crawler treads it was possible to compact the refuse. This served a twofold purpose: it reduced the volume of the bulky mass that could be placed in a given space and it also discouraged rat breeding.

The success of the Rikers Island experiment in eliminating nuisance and other undesirable features that usually accompany refuse dumping led to the conviction that the land-

Fig. 1. This is a corner of Baisley Park which the Department of Sanitation undertook to reclaim by use of the land fill method of refuse disposal.

fill scheme, with refinements, might be more widely applied to less isolated spots. Accordingly, several tracts of low-lying land varying in size from 12 to 400 acres were selected in various parts of the city as demonstration areas. During July seven of these were being worked, and the writer spent two days in observing the methods employed.

Technique employed

Typical of the routine developed for handling refuse at a fill are the operations at the 100-acre site in the Jamaica Bay area of Brooklyn, known as the Fairfield and Pennsylvania Ave. fill. Here some 3,300 cu.yd. of material are handled each day during the summer season; in the winter the volume is almost doubled because of the increase in ash collections.

This area is just above tide level and is covered with a dense growth of marsh vegetation. Underlying the vegetation is a sandy soil. Operations at this place are conducted as follows: A dragline excavating machine (with a 75 ft. boom and 1½ cu.yd. bucket) digs a trench some 30 ft. in width and 4 to 6 ft. in depth, along a front of about 200 ft. The excavated sand is piled one side for later use as cover material. The trench is made for two reasons: to obtain cover material and to gain additional space for refuse deposition.

Collection vehicles dump their loads on top of the completed parts of the refuse fill, about 50 ft. from the edge of the fill which borders the trench. A bulldozer then spreads the piled material by pushing it toward and over the edge into the trench, and as the machine moves back and forth it compacts the refuse. Load after load is dumped along this front until the trench is filled and the desired elevation is reached. At the Jamaica Bay site the elevation was such that a fill of some 12 ft. depth could be made.

The front of the refuse fill remains at a very steep slope. Therefore, it is possible to continue dumping operations until the outer edge of the trench is reached before excavation is begun to widen the trench.

While dumping operations are being carried on along one front, the dragline equipment works at another corner of the lot where a section of fill has previously been completed. Excavation is then begun on the trench extension at the end of the fill. Part of the material taken out is spread over the exposed surface of refuse to cover it for a depth of 9 to 14 inches. The remainder is placed in a stock pile for later distribution to form the final cover.

With this routine, the deposited refuse is covered with an earth seal every second or third day. Shortly thereafter a final covering of earth, with a minimum thickness of 2 ft., is applied. In the interval between the first and final covering, the movement of trucks and other rolling equipment over the fill provides an opportunity for thorough compaction so that the final covering can be made with good assurance that the grade will remain level.

It should be noted that the essential

Fig. 3. To prevent nuisance on the fills: a fence barrier to catch blowing paper; water hydrant facilities for fire-fighting; and dust-control spraying on roads.

Fig. 2. This is the reclaimed corner of Baisley Park six months later after 350,000 yd. of refuse had been deposited, compacted and covered.

element of the scheme is concentration of dumping along a relatively short and narrow face instead of spreading it out over a wide area. This makes it possible at frequent intervals to cover the deposited refuse with earth and thereby inclose the material in a seal which prevents odors and other nuisances, in addition to disguising what is beneath it.

Another factor of considerable importance is the use of a heavy bulldozer machine to spread and compact the material. Much of the success of the land fill is dependent on this initial compaction; not only does it reduce the bulk of the mass and thus minimize later settlement but it is said to have a profound influence on the elimination of rat breeding. Although these rodents normally find refuse dumps an ideal habitat, they have been conspicuously absent from the land fills. To bear out this assertion, the Department of Sanitation not only has reports from night watchmen on the fills but also the statement of the prison warden on Rikers Island where, in times past, the rats were a veritable plague.

Finally, it should be observed that by alternating working on two fronts, it is possible to utilize the relatively expensive excavating machinery at its maximum efficiency. In fact, at the present time, the dragline excavating and covering operations are carried on 16 hours, or two shifts a day, in order to keep pace with the single 8-hr. shift during which the collection vehicles work.

From the foregoing it is evident that operations at a land fill are in striking contrast to the haphazard methods employed at a refuse dump. There are also a number of other features which distinguish it.

Chief among these are the precautions taken to prevent offense either to eye or nose. While it is true that concentrating disposal on a small front and prompt covering of the refuse eliminate the major source of criticism, additional efforts are taken to prevent the possibility of nuisance. For instance, a solution of creosote is sprayed over the working area of the fill and on the access roads several times a day. For this purpose, a street flusher is used. The spray serves not only to blanket odors that may arise from any temporarily exposed refuse, but it is effective in combating flies and reducing dust.

To screen the operations and also to prevent paper from being blown about during windy weather, a removable type of wooden slat fence is erected a few hundred feet back of the working face of the dump. This fence is moved forward as the fill progresses. In certain locations, a stock pile of cover material is placed where it also serves as a screen.

Since a fire on a dump is both a hazard and a nuisance, special care is observed to prevent such an occurrence. Accordingly, starting fires is strictly forbidden at all times, and none but authorized employees and salvage contractors are permitted to enter a land fill. At the fill adjoining the Floyd Bennett Airport, where the smoke from a fire would endanger air traffic, a water line with hydrant attached every 300 ft. has been installed. In fact, states the Department of Sanitation, there have been no fires either from external ignition or spontaneous combustion on any of the land fills.

One matter which deserves em-

Fig. 5. No delays in dumping at the fill. Trucks can be accommodated as fast as they arrive and the tractor quickly spreads and compacts the loads.

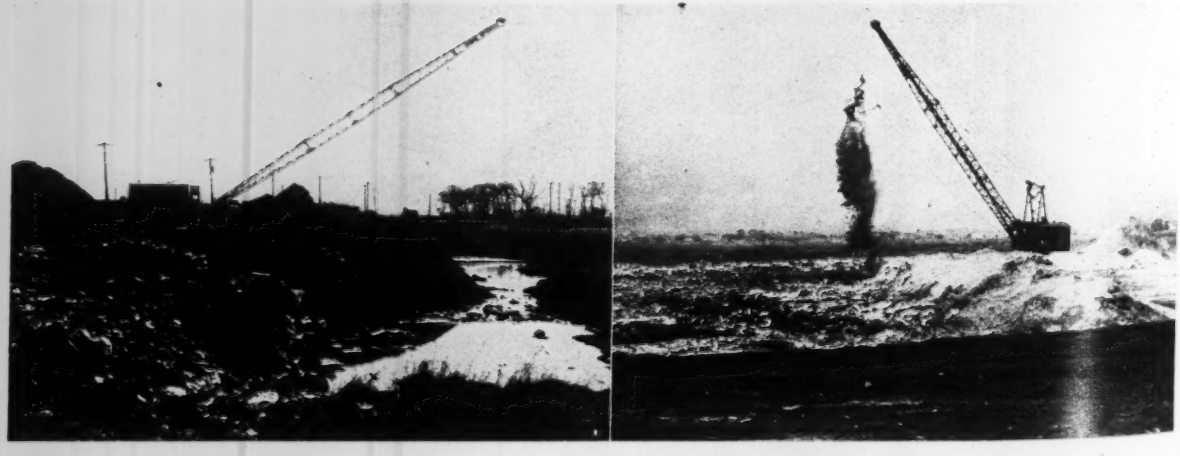

Fig. 4. Digging the trench at the front of the fill to gain earth cover material (left) and spreading the earth over a completed portion of the fill.

phasis is the attention given to access roads. Both to keep down trucking costs and delays and to preserve a neat and orderly appearance of the land fill, the roads leading to the face are well built and kept in first-class condition. The roads, constructed on top of the finished fill, are made with a 12-in. base consisting of old paving material and discarded building debris, covered with ashes.

All material which comes to the fill and is suitable for road building such as broken concrete, pieces of torn up asphalt, brick, etc., is segregated. When it is desired to extend the road, this material is hand placed, rolled, and covered with a 3-in. layer of ashes. Frequent use of a grader helps to keep the roads smooth and properly crowned. Aside from the psychological advantage of a carefully aligned and rut-free road leading up to the fill, there is the more practical aspect of providing a smooth surface for heavily loaded trucks, thus eliminating breakage of springs and other damage.

Fig. 7. Salvage operators remove bed springs, metals, etc. and this is an aid in securing proper compaction of the fill.

Fig. 6. The completed face of an elevated refuse fill which forms a bowl around an existing park. The fill is being extended behind the fence barrier.

All of the fills now in operation are not yet completed. However, an example of what the eventual result will be is evidenced by some work that was done in a hollow adjoining Baisley Park, a neighborhood recreational area in Jamaica. This 8-acre hollow, some 16 ft. deep and nothing more than a swampy morass overgrown with weeds, belonged to the Park Department, which could do nothing with it until it had been filled. Permission was given to the Sanitation Department to make the fill using refuse, providing the work could be accomplished in six months during the winter. Some 350,000 cu.yd. of refuse were dumped and covered, using the land fill principle heretofore outlined. On April 1, exactly six months after the start of operations, the former hollow was transformed into a level field ready for landscaping into additional park area.

Why use land fill?

While the low cost of the land-fill method is the chief argument for its use—averaging 0.06 cents per cu.yd. as against 0.23 cents for incineration in New York—there are other reasons why it recommends itself. Among these are the possibility of "reclaiming" thousands of acres of low-lying land, and the opportunity to postpone the time when huge capital outlays will be required for more incinerator capacity.

The reclamation feature is of particular importance because it not only will eliminate many neighborhood eyesores and mosquito breeding areas but in so doing will add to the taxable value of the land. And not to be overlooked is the fact that, where the refuse fills are being made on Park Department property, the program of adding recreational facilities to the city will be greatly accelerated. For fills to be made with material other than refuse the cost of park development would be prohibitive in many places.

Extension of the land fill scheme to the islands in Jamaica Bay—an 16,000 acre area—is under consideration by the Department of Sanitation, although no official announcement regarding the plan has yet been made. Many of these islands are partly submerged, and without being filled and raised in elevation would be useless for either industrial or recreational development.

The work of the Department of Sanitation is under the direction of William F. Carey, commissioner. J. M. Morton and W. J. Powell are the deputy commissioners in charge of the operations and waste collection divisions, respectively. Supervising the work at the land fills is A. J. Lizee, assistant to the commissioner of the department.

British Building Sets an Example

EDWARD J. MEHREN
Phoenix, Ariz.

Wage and working negotiations carried on by a joint council of labor and employers while public relations are also the responsibility of industry-wide groups

ANYONE familiar with the building industry in America will be quite surprised at the thoroughness of building trade organization found in Great Britain and especially at some of its novel features. Two of these, in particular, warrant description—the fixing of exceptional wage rates for unusually large jobs in isolated regions, and the plan for making payments to workers for time lost in wet weather. It is proposed to describe these features in this article and then to make reference to two broad plans of cooperation participated in by contractors, unions, architects, materials suppliers and several other groups.

General wage plan

The "exceptional wage" plan is not intelligible unless one understands the general wage plan of the British building industry, and that, in turn, is bound up with the general scheme of the industry's organization. The great majority of important building contractors are members of a countrywide association known as the National Federation of Building Trades Employers. The workers are joined together in national unions and these, in turn, are members of the National Federation of Building Trades Operatives. These two federations, finally, as well as some additional groups, constitute the National Joint Council of the Building Industry. Thus there are two dominant bodies, united in the Joint Council, representative of nearly the entire industry and able, therefore, to carry on negotiations on a national scale.

When, in 1920, the plan of national determination of wages was adopted, the wages existing in various towns were allowed to stand. At the same time a grading system was adopted, with ten grades, varying, for the skilled trades by one-half penny per hour, and with a special rate for London. The towns fell into one of these grades with but little adjustment. However, local unions in a town could then, and can now, petition for a change of grading. The application for re-grading is considered, hearings held and decisions made by the Grading Commission of the National Joint Council.

Wage details

The following factors are weighed in considering the re-grading of a town: population, character of area, whether mainly industrial, residential or agricultural; rates in nearest towns and districts and distances from the point in question to these towns and districts; rents, taxes, prices of coal, gas and electricity; transportation facilities in the town and to neighboring towns; chief local industries and wage rates of skilled and unskilled workers employed therein; number of building trades craftsmen and employers in the town or district; prevalent degree of building activity and average number of building trades craftsmen unemployed during recent months.

Wages of all skilled mechanics—masons, carpenters, plumbers, painters—are the same, and vary at present from 1s. 3d. to 1s. 7½d. per hour. London has two special rates of 1s. 9d. in inner London and 1s. 8½d. in outer London. The laborer's rate is 75 per cent of that of the skilled mechanics. Wages are tied to the cost of living, rising and falling with it according to an agreed formula.

Differentials are allowed for exceptional kinds of work, such as furnace and hot work, foul or dirty work (as in repairs of sewers and work in chemical plants), high chimney and steeple repairs, working in water, etc.

Hours are 44 per week during the winter and 46½ per week during the summer. Some of the larger districts, including London, maintain by agreement the 44-hr. week throughout the year. Overtime is paid as follows: for the first two hours, time and a quarter; the second two hours, time and a half; afterwards, double time: Saturday afternoon, until 4 P.M., time and a half; late Saturday and all day Sunday, double time.

In support of national determination of wage rates it is pointed out that this method avoids striking irregularities between nearby towns based not on sound grounds but on differences in bargaining ability. It prevents, also, the use of a higher rate in one town to force an unjustified concession in another.

Exceptional wage rates

The practice of setting exceptional rates grew out of conditions similar to those we experienced in building the cantonments during the war. These jobs were exceptionally large and were located in areas of limited labor supply. Men had to be brought from a distance. Wages shot up. In consequence we had to adopt a cost-plus basis. At the same time, the wage levels in adjoining communities were upset.

Now, in Britain, when an unusually large project is to be built in a location with inadequate labor supply, operatives and employers petition the Grading Commission for an "exceptional margin" *for that job*, which margin is an additional rate per hour over and above that of the grade obtaining in a nearby town or towns. It is established for that job

only, is granted for six months, and then expires unless application is made for extension. Rates in the nearby communities are unaffected.

"Exceptional margins" have in recent years, during Britain's rearmament drive, been frequently granted for government jobs, notably for aerodromes. For such construction the government will not allow extras on account of wage increases but it does expect that the job will be finished on the basis of an exceptional rate. In other words, it is willing to pay higher than the normal district rate, but only if and to the extent that an exceptional rate is granted by the Grading Commission. This, by the way, is a commentary on the official recognition accorded by the government to the Joint Council.

Employers and employees, questioned about the operation of the system, declared that it was quite satisfactory and, in their view, a workable solution of an otherwise troublesome problem.

Features of British Plan For Building Industry Cooperation

1. A single national union and a single national contractor federation join hands to fix wages and working conditions.

2. All skilled workers in a given locality get same wage and unskilled 75 per cent as much, all rates being periodically adjusted to the cost of living.

3. A wage grading system, applied to towns and districts, takes care of necessary regional differentials.

4. Special higher rates are fixed for large projects in locations having inadequate labor supply.

5. An insurance scheme is planned to permit payment for time lost on account of bad weather.

6. Builders build houses to industry standards, and industry council issues certificates to owner guaranteeing the workmanship.

7. A council encompassing all branches of building looks after public relations, building code and standardization matters and governmental cooperation.

Wet weather payments

The second feature—payment for time lost on account of wet weather—is a courageous, well-thought-out and promising attack on a very difficult problem. It is an insurance scheme involving the creation of a fund, contributed to by both employers and employees, from which payments are to be made when work is interrupted by rain, hail, frost, snow, sleet or fog.

As early as 1919 discussions were held on this subject between employers, operatives and the government with reference to wet weather payments on work carried out under the Housing Act. But the conversations came to naught. They were later renewed, but on a broader scheme, to include all building operations. The final plan has now been agreed to by the two federations and will shortly be laid before Parliament by and with the support of the government.

It provides for the setting up of the "Building Industry's Supplementary Unemployment Insurance Scheme." If approved by Parliament, it will become an addition to the Unemployment Insurance Act and will be made legally binding upon all building trade operatives and employers. The building industry will be defined as "the construction, alteration, repair, decoration or demolition of buildings, including the manufacture in builders' workshops or yards of any fittings of wood, metal or worked stone."

Contributions will be made as follows: craftsmen over the age of 21, 1s. per week; laborers over 21, 9d. per week; youths between 16 and 21, 5d. per week. Half of this contribution will be paid by the employee, half by the employer. The rate of benefit for time lost is to be 9d. per hour for craftsmen, 7d. per hour for laborers, 4d. per hour for youths. Referring back to wage rates, quoted above, it will be noted that for craftsmen receiving the median wage of 1s. 5¼d. per hour, the wet weather benefit would be roughly 50 per cent of the time rate now being paid. Benefit payments would not be made until 12 months after the beginning of contributions to the fund.

It is estimated that about 1,000,000 building trades operatives would be covered by the scheme.

Administration

It is evident that much detail will be necessary in administrating a plan of this kind. While the scheme would have legal status and come under the Unemployment Insurance Act (this is the method proposed to make it compulsory on all in the industry), its administration would be left to a joint board composed of equal numbers of representatives of employers and operatives. The rules would have to have the sanction of the Minister of Labor. Thereafter he could intervene on questions of major importance, but, aside from such issues, it is contemplated that administration will be left entirely to the joint board.

Claims courts would be set up in every community or district to decide disputes. Each would be made up of a representative of the operatives, a representative of the employers and an independent chairman. The decisions are to be final and binding. The joint board will examine the claims dealt with but will have no over-riding or nullifying power.

Since contribution is compulsory, the Ministry of Labor will have inspectors to examine employers' books and see to it that the proper contributions are paid. (Some sort of stamp system for workmen's cards is likely to be developed). Fines and imprisonment are to be provided for violation.

All British workers, including those on buildings, are covered by the Unemployment Insurance Act. The new scheme is not to replace the

latter, so far as building workers are concerned, either wholly or in part. It is supplemental thereto.

In Britain, when a period of protracted bad weather threatens to set in, as at the beginning of winter, the building worker at once applies for unemployment benefit. However, the law prescribes a waiting period of 3 days before he can begin to draw benefits. That procedure will still apply. In other words, benefit payments during the more or less protracted winter lay-off will come from the normal Unemployment Insurance Fund.

It is in the "waiting period" at the beginning of winter and in the short intermittent losses of time during the normal building season that the new fund is to operate. But for protracted lay-offs, once the waiting period has expired and the worker begins to get benefits from the normal fund, his benefits from the bad weather fund cease. He cannot draw benefits from the two funds at the same time.

Date of approval of the plan cannot be foretold, but with the backing of the government and both the employers' and the operatives' federations, strong opposition and long delay are not anticipated.

Broad programs of cooperation

The third point to be dealt with is the broad program of cooperation existing in the British building industry. One part of this program is an effort to protect the public against the "jerry builder" and his product, the jerry-built house. In this effort are joined together the National Federation of Building Trades Employers, the National Federation of Building Trades Operatives, the Royal Institute of British Architects, the Chartered Surveyors' Institution, the Building Societies' Association (the building and loan group), the Auctioneers' and Estate Agents' Institute (the real estate group) and the Council for the Preservation of Rural England. The body is known as the National House-Builders' Registration Council.

It undertakes to issue certificates stating that houses to which they apply conform to a model standard specification which the Council has had drawn up by a committee of experts, presided over by Sir Raymond Unwin, past president of the Royal Institute of British Architects. Inspections, generally five in number, are made at stages of the work when they will be most revealing and effective. The builder must agree that, at the request of a purchaser made prior to conveyance, he will enter into a binding, legal agreement with said purchaser to make good, free of cost, all defects in the house attributable to non-compliance with the Council's standards, which appear and are reported to the builder within a period of two years from the date of sale. The purpose of this precaution is to insure the owner against defects due to a violation of standards which might have occurred between inspections and have been concealed in the progress of building. Any dispute arising under such agreement is heard by an assessor or tribunal, appointed by the Council, whose decision is binding on both parties.

Builders desiring to cooperate under the scheme can register with the Council and must agree to comply with its standards, to permit and cooperate in inspections made by the Council's representatives, to apply for certificates on every house they build for sale, and to enter into the compensation contract with the purchaser, above set forth. The penalty for failure to comply with these requirements is removal from the Council's register.

The Council held its first meeting in January, 1937. There are now 1,196 firms on the National Register of House-Builders, 3,500 houses have been certified, and a further 3,000, now in course of construction, will be certified in due course. The costs of inspection and administration are met out of fees paid by builders for certificates and for registration.

The Council naturally makes use of all available channels for propaganda. During the present summer thirteen public meetings have been held in large towns and cities throughout the country, all of which have been well attended and very fully reported in the press. Then of course firms who are on the register and in a position to supply the public with certified houses lose no opportunity of stressing this fact in their advertisements and are frequently successful in obtaining helpful editorial reference to the scheme. All news about the progress of the Council appears monthly in its official journal, the Housing Supplement of "The National Builder." Use is also made of poster advertising.

The Council's officers are fully satisfied, as a result of a year's working of the scheme, that it is soundly conceived and of benefit alike to the purchasing public and to the sound and reputable house-builder.

Coordinating the industry

The final item for discussion is the top coordinating body of the entire industry, known as the Building Industries National Council. Its functions are much the same as those proposed for the Construction League of the United States by A. P. Greensfelder, though that body covers public works construction as well as buildings. In the British organization are included representatives of the British Institute of Architects, the National Federation of Building Trades Employers, the National Federation of Building Trades Operatives, the Building Materials Manufacturers' and Suppliers' Committee, the Chartered Surveyors' Institution, the Reinforced Concrete Association, and the British Electrical and Allied Manufacturers' Association.

The Council was formed in 1932 and functions through four principal committees: (a) a general purposes committee, (b) an advisory committee on building acts and by-laws and related questions (covering what we call "building codes"), (c) a technical committee for review, and (d) a special committee for public relations. The building acts and by-laws committee, in particular, has done notable work on codes, covering plumbing, fire prevention, elevators and escalators. The technical committee for review handles standardization, while the public relations committee deals with the relation of the industry to the general welfare and with such matters as public housing policies and the use of the industry in mitigating slumps and booms.

It will be seen, therefore, that the Council takes under its wing work that, in the United States, is partly neglected, such as public relations, and partly scattered among various bodies. The merit of pulling them together in one place is obvious: It creates solidarity in the industry.

allows of more effective coordination, creates an agency that can speak for the industry as a whole. In fact, in approaches to the government in 1931 by representatives of industry over government action considered inimical to the industry's interests, Cabinet Ministers pointed out that the government could give no great consideration to those or to any future like contentions unless and until the industry could speak with one fully representative and constitutional voice. It was this expression by the Ministers that led to the formation of the Council. Certain co-operative bodies then in existence were amalgamated, and to this nucleus were added other functions and supporting bodies.

In general, one cannot but be impressed by the vigorous and effective manner in which the industry has organized itself in Great Britain. It has tackled baffling problems courageously. Apparently there is widespread opinion that the industry can solve many of its difficulties if it organizes to do so, subjects these difficulties to thorough analysis, and takes steps to carry out whatever action is indicated.

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Boulder Dam Architecture

WHEN C. G. Kaufmann, Los Angeles architect, was appointed consultant to the Bureau of Reclamation, he entertained some doubt as to whether successful results could be achieved by engineer-architect co-operation with structures on which the engineer had the controlling influence. Eight years' experience, first on Boulder Dam and later on Grand Coulee and Shasta dams, brought Mr. Kaufmann many pleasant surprises. He writes about them and about the architecture of Boulder Dam in the latest *Monthly Bulletin* of the Illinois Society of Architects.

"I cannot imagine", writes Mr. Kaufmann, "any experience that has been as broadening and refreshing as my association with some of the finest engineers of the country, and the nicest part of it is that my education was quite gentle and painless, and I count it all as clear gain. Now I find myself as conscious of the engineering necessities as the engineer and, in turn, the engineers of the bureau are as much concerned with the appearance as the consulting architect. This, of course, is just what the relationship should be."

Mr. Kaufmann points out that there was never a definite theme with respect to Boulder Dam architecture. Rather the attempt was to give form to the engineering requirements step by step, "often hesitating, sometimes stepping backwards, but never sidewise." The following is abstracted from Mr. Kaufmann's account.

The smooth plastic possibilities of concrete together with the shape and size of the dam seemed all that was necessary except at the crest. Viewed from below, it was felt that some stabilizing element should be introduced where the top of the dam reached up and met the sky. The size and scale of the project precluded any trivial motifs like balusters, or bands or grooves, and, in addition such embellishment was pointless.

The elevator towers and rest rooms on top of the dam were developed quite logically to be equal in size, but the plain parapet between these towers seemed still to lack rhythm, until the projecting platforms, spaced evenly between the towers, were developed. Furthermore, it was desirable to create some place or places on top of the dam from which a vertical view could be obtained. Plaster models were made at 1/20th in. to the foot for the whole dam, and $\frac{1}{8}$ in. for the towers, and much study was given before the scheme finally took its adopted form.

The intake towers in the lake offered many interesting possibilities, the size, plan, and height generally being pretty much established by their purpose and functions. An original plan for concrete louvres instead of windows was abandoned when it developed that 9,600 lineal ft. of the louvres would be required. "Obviously that was no way to advocate spending public funds."

Study of the huge power house at the foot of the dam covered a considerable period of time. Plaster models were made at 1/20th and larger scale.

Vertical treatment of the structure seemed to develop automatically due to construction joints every 60 ft. These joints are actual separations with double columns and double roof trusses, each carrying independently their respective sections of building. Only a limited amount of fenestration was needed, the width of the wings and central portion making it impossible to consider daylight as the sole means of light.

In studying the windows, it developed that the spray from the needle valves contributes greatly to corrosion of metals. Careful investigation finally developed that aluminum would satisfy the practical, esthetic, and economical requirements, and so all windows, doors, and railings throughout are of aluminum.

The painting of equipment was studied carefully by Allan True of Denver, a mural painter of note, who also designed the terrazzo floors in Indian motifs, the permanent recording of these being justified by the general locale.

Oskar Hansen won the competition for the sculptural panels over the elevator tower doors, as well as the flagpole and surrounding treatment on the Nevada approach. This work, which is now nearing completion, marks the end of all of the external phases of the project, with the exception of a small building to house the guides, forest rangers and first aid station. Being a relatively small building among this "mass of vastness," it requires particular attention. Furthermore, there are no engineering requirements, and it is quite surprising, says Mr. Kaufmann, how the lack of such limitations seems to increase, rather than decrease, the problems from an architectural point of view.

"On each side of the entrances to the elevator towers," concludes Mr. Kaufmann, "there are bronze tablets commemorating the names of officials, engineers, consultants, and contractors who took part in this great venture. These names represent men I have learned to admire and respect, not only for their individual qualities and abilities, but also for the fine team work they have achieved all along the line."

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Pruning Shears For Clearing Line

J. S. DODDS

Professor of Civil Engineering
Iowa State College, Ames, Ia.

We have found that the axemen and brushers in rocky country experience considerable difficulty keeping tools sharp when brushing lines, on account of the effect of rocks upon cutting edges.

At Camp Marston, we have equipped the brushers with high grade hand pruning shears for clearing lines and it has been found that small trees and all brush, up to a diameter of at least 1 in. can be bent over with the left hand and clipped off close to the ground with the right hand and in less time than it takes to clear a line with either brush hooks or machetes.

Although the use of pruning shears requires bending over, it is possible to do less cutting to secure visibility for a transit-man and clear line for the chain-man than with the other equipment.

It has been found that with pruning shears the limbs on small trees and large trees can be removed at particular spots without damaging the trees or cutting shrubbery needlessly. This feature is very important when surveying on valuable estates.

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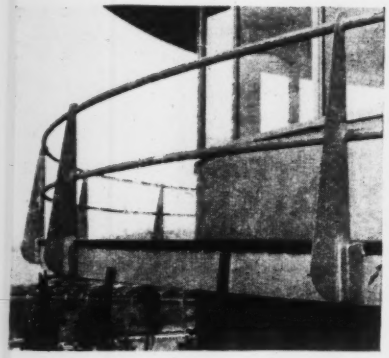
Plate Posts Improve the View

This is the railing on the walk encircling the "Roundhouse," the unique restaurant on the toll plaza of the Golden Gate Bridge, at San Francisco. One of the major attractions to the place is the view: Patrons sit just inside of the windows all around the outer edge and, presumably gaze out between bites. As the view is more or less downward through the railing, bulky posts would obstruct it. By using plates for the upright supports adequate strength and stiffness is provided and only the edge of the plates is an obstruction to vision. The support at the base is a short piece of angle, welded to the plate, with bolt holes for bolting to the floor beam. Joints with the horizontal rails are welded. The picture was taken before the final coat of paint was applied.



Railing on the walk around the "Roundhouse," Golden Gate Bridge, is supported by plate posts.

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Concrete Stair Joint

In constructing of concrete stairways, the S. M. Siesel Construction Co., of Milwaukee, always pours the lower third of the lower flight of stairs with the floor slab below; the remainder of the stairs is poured with the floor slab above. The reason for this division of operations is that the plane of minimum shear in a concrete stairway is at the lower third point of the lower flight, which is, therefore, the logical location for a construction joint.

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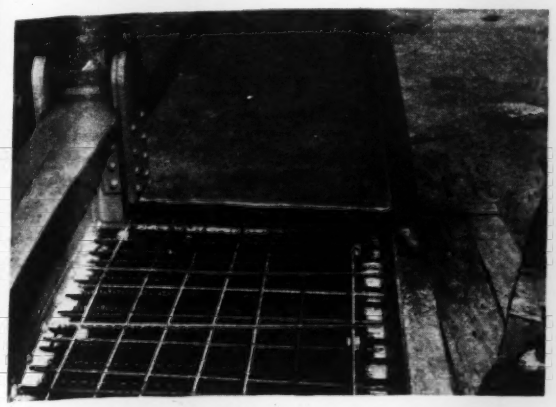
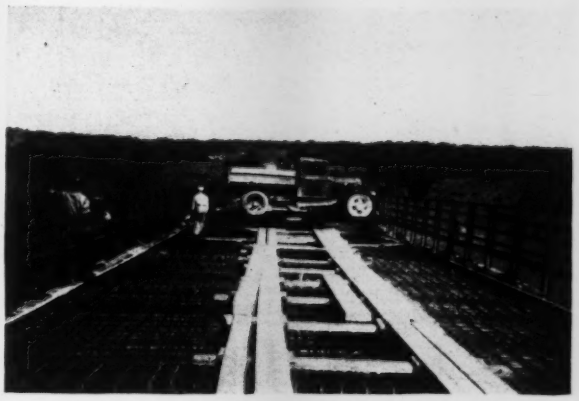
For the Right-of-Way Agent

Table of Right-of-Way Acreage Computed by H. H. Roberts, draftsman, Office Okanogan County Road Engineer, Okanogan, Wash.

LENGTH IN FT.	WIDTH IN FEET										
	5	10	20	30	40	50	60	70	80	90	100
1	.0001	.0002	.0005	.0007	.0009	.0011	.0014	.0016	.0018	.0021	.0023
2	.0002	.0005	.0009	.0014	.0018	.0023	.0027	.0032	.0037	.0041	.0046
3	.0003	.0007	.0014	.0021	.0027	.0034	.0041	.0048	.0055	.0062	.0069
4	.0005	.0009	.0018	.0027	.0037	.0046	.0055	.0064	.0073	.0083	.0092
5	.0006	.0011	.0023	.0034	.0046	.0057	.0069	.0080	.0092	.0103	.0015
6	.0007	.0014	.0027	.0041	.0055	.0069	.0083	.0096	.0110	.0124	.0138
7	.0008	.0016	.0032	.0048	.0064	.0080	.0096	.0112	.0129	.0144	.0161
8	.0009	.0018	.0037	.0055	.0073	.0092	.0110	.0129	.0147	.0165	.0184
9	.0010	.0021	.0041	.0062	.0083	.0103	.0124	.0144	.0165	.0186	.0207
10	.0011	.0023	.0046	.0069	.0092	.0115	.0138	.0161	.0184	.0207	.0230
20	.0023	.0046	.0092	.0138	.0184	.0230	.0275	.0321	.0367	.0413	.0459
30	.0034	.0069	.0138	.0207	.0275	.0344	.0413	.0482	.0550	.0620	.0689
40	.0046	.0092	.0184	.0275	.0367	.0459	.0550	.0643	.0735	.0826	.0918
50	.0057	.0115	.0230	.0344	.0459	.0574	.0689	.0803	.0918	.1033	.1148
60	.0069	.0138	.0275	.0413	.0550	.0689	.0826	.0964	.1102	.1240	.1378
70	.0080	.0161	.0321	.0482	.0643	.0803	.0964	.1225	.1286	.1446	.1607
80	.0092	.0184	.0367	.0550	.0735	.0918	.1102	.1286	.1469	.1653	.1837
90	.0103	.0207	.0413	.0620	.0826	.1033	.1240	.1446	.1653	.1860	.2066
100	.0115	.0230	.0459	.0689	.0918	.1148	.1377	.1607	.1837	.2066	.2296
200	.0230	.0459	.0918	.1378	.1837	.2296	.2755	.3214	.3674	.4133	.4592
300	.0344	.0689	.1378	.2066	.2755	.3444	.4132	.4820	.5509	.6198	.6887
330	.0379	.0758	.1515	.2273	.3031	.3788	.4545	.5303	.6061	.6818	.7576
400	.0459	.0918	.1837	.2755	.3673	.4591	.5509	.6428	.7346	.8264	.9184
500	.0574	.1148	.2296	.3444	.4591	.5739	.6887	.8035	.9183	1.033	1.148
600	.0689	.1378	.2755	.4132	.5509	.6887	.8264	.9641	1.102	1.238	1.378
660	.0758	.1515	.3031	.4545	.6061	.7576	.9091	1.060	1.212	1.364	1.515
700	.0804	.1607	.3214	.4820	.6428	.8035	.9641	1.125	1.286	1.446	1.607
800	.0918	.1837	.3674	.5509	.7346	.9183	1.102	1.286	1.469	1.653	1.837
900	.1033	.2066	.4133	.6198	.8264	1.033	1.238	1.446	1.653	1.856	2.066
990	.1136	.2273	.4546	.6818	.9091	1.136	1.364	1.591	1.818	2.045	2.273
1000	.1148	.2296	.4592	.6887	.9183	1.148	1.377	1.607	1.836	2.066	2.296
1320	.1515	.3031	.6061	.9091	1.212	1.515	1.818	2.121	2.424	2.727	3.030
2000	.2296	.4592	.9183	1.3775	1.837	2.296	2.755	3.214	3.673	4.133	4.592
2640	.3030	.6061	1.212	1.818	2.424	3.030	3.636	4.242	4.848	5.454	6.061
3000	.3444	.6888	1.378	2.066	2.755	3.444	4.132	4.821	5.510	6.198	6.887
4000	.4592	.9184	1.837	2.755	3.673	4.592	5.510	6.428	7.346	8.264	9.184
5000	.5740	1.148	2.296	3.444	4.591	5.740	6.887	8.035	9.183	10.330	11.478
5280	.6061	1.212	2.424	3.636	4.848	6.061	7.273	8.485	9.697	10.909	12.121





TWO CAMERA HINTS ON BRIDGE PAVING

On the Thousand Islands Bridge just completed across the St. Lawrence River, the camera caught two devices of interest used by Street Brothers Construction Co., Syracuse, N. Y., the subcontractors for the concrete paving.

At the left is shown the metal lath form used for sidewalk slab instead of the ordinary tight wood panel. The lath, with the ribs running transversely, was grouted to the angles carrying the slab and on it were set precast concrete blocks to hold the slab reinforcement. The concrete was placed in the ordinary manner and astonishingly little was lost through the lath mesh.

At the right is shown the turntable set on a steel crossbeam of the bridge floor system to turn the concrete trucks near the point of placement to permit rear dumping of the trucks. The trucks operated over narrow runways set on the slab form system. The runways were blocked up as ramps to meet the level of the turntable. The turntable was operated by hand. Turnouts every 1,000 ft. or so permitted the operation of trucks.

Sign Language Numerals

MILTON A. KARP
New York, N. Y.

In surveying work, the rodman is often beyond hearing distance of the instrument man or the note keeper. Quite often, a rod reading or a target setting must be communicated from one party to another. Rather than waste time in having one party walk out to the other, a signal system for numbers seems desirable. An added advantage of the signal system is that there is less chance of error through its use, than there is in shouting across an appreciable distance. The following is a set of signals I have come across while surveying, which is simple, quick and easy to give and read.

One—The left arm is extended downward at a 45 deg. angle to the horizontal.

Two—The left arm is extended horizontally.

Three—The left arm is extended upward at a 45 deg. angle to the horizontal.

Four—The right arm is extended downward at a 45 deg. angle to the horizontal.

Five—The right arm is extended horizontally.

Six—The right arm is extended upward at a 45 deg. angle to the horizontal.

Seven—Both arms are extended downward at a 45 deg. angle to the horizontal.

Eight—Both arms are extended horizontally.

Nine—Both arms are extended upward at a 45 deg. angle to the horizontal.

Zero—One arm is waved in a circle.

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Laying Out Cheek Cuts On Cripple Rafters

D. GRIFFITHS
Pittsburgh, Pa.

When confronted with a roof framing job, probably the chief difficulty faced is obtaining the bevel or cheek cut on the hip and valley rafters, commonly called cripple rafters. If the laying out of this cut is looked upon as the simple projection of the thickness of the material, the problem is easily solved, as the accompanying sketch shows.

For any pitch of roof *xy:yz* draw the line *a b* which is the plumb cut. The thickness *t* of the rafter used is then measured off along the face of the rafter parallel to *a b* and marked at *c*.

By squaring across the top of the rafter, *d* is marked on the far edge. Connecting the marks *d* and *a* gives the plane *d a b* which is the cheek cut for any pitch of roof.

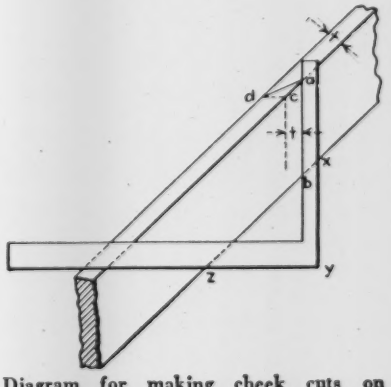

Diagram for making cheek cuts on cripple rafters

$3 to $5

paid on acceptance for items suitable for the pages of From Field and Office

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

BETTER SEDIMENTATION — Scientific study of sedimentation has never been easy. In spite of the apparent simplicity of clarification by sedimentation, a large number of factors must be taken into account. Holroyd (Proc. Institute Sewage Purification, England, Part 1, p. 62, 1937) studying sedimentation in operating radial flow tanks states, for instance, that the drag of the walls in a rectangular tank causes the flow distribution to "bulge" forward, greater velocity occuring on the axis than elsewhere. The general criterion of flow conditions in large channels (Reynolds' number) is of doubtful application in tanks. The Reynolds number in a radial flow tank with 3 hr. detention is of the order of 10,000 and does not vary greatly with widely varying sections. This figure would normally indicate turbulent flow, but becomes manifest in the form of instability of flow. True streamline flow can scarcely be maintained in a working settling tank, but high velocity in the center, decreasing towards the boundaries, will occur to some extent. Flow distribution across the section of a rectangular tank can be adjusted by inlets and outlets to obtain stable flow conditions.

This finding is in accord with Camp's suggestion (*Sewage Works Jour.* Jan. 8, 742, 1936) that the more the center velocity is increased relative to the side velocity the better is the stability of flow. At very low rates of flow the center flow in a tank may gain kinetic energy at the expense of the flow near the walls in a rather haphazard manner. The English investigator states that in a circular radial flow tank no such vertical boundary exists. Even distribution from a circular inlet weir will automatically spread in concentric circles to the circular outlet weir. The vertical distribution of flow is curved but since the depth of flow is much less than the width this is of less importance. The wave front tends to bend downward in a vertical plan since the drag of the floor is greater than the drag of the surface, hence solids deposition will be assisted. It is concluded that radial flow provides much more satisfactory sedimentation than transverse flow.

GARBAGE AND SEWAGE—Experimentation in composting garbage and sewage sludge for the production of manure have long followed the practice of spreading on land, piling in heaps or trenching. Some interesting large scale experiments have been reported from Egypt (Carter and El-Din Fahmy, Cairo Govt. *Bull.* 12, Nov., 1937) where heaps of refuse were sprinkled with sewage or sludge and turned over at intervals of one to four weeks. To accelerate digestion proper seeding was employed by having alternate layers of refuse, sludge, and digested material. From the agricultural point of view the presence of certain salts in refuse may be injurious to plants and therefore the greater the quantity of sewage used in composting the more salts were washed out. The high temperatures evolved by fermentation are considered sufficient to destroy most of the harmful bacteria; only in one case out of 37 samples was there a single hookworm egg found.

PEA CANNERY WASTE—In Wisconsin cooperative efforts between the Canners' Association and the State Board of Health have resulted in the development of a treatment process capable of reducing the oxygen demand of pea canning and similar wastes from 50 to 75 per cent. Warrick (*Food Industries*, Jan. 1938, p. 20) describes the treatment of blancher effluents, produce washings, and floor and equipment washings. The volume of waste amounts to about one gallon per No. 2 size can (20½ oz.) of peas packed. Treatment consists of screening, and application of 3.25 lb. ferrous sulfate and 7.25 lb. of lime per 1,000 gal. Thorough mixing and one hour settling are required. It is of interest to note that the fill and draw system is found to be far superior to the continuous flow system of treatment.

SLUDGE IN LAKES—Construction of lakes and ponds for the purification of the effluent from sewage treatment plants has led to the fear that considerable sludge deposits may be formed. Even if sewage is treated to a higher degree than that accorded by sedimentation, finely divided material will settle or it is coagulated with the resulting formation of sludge deposits. Imhoff (*Rundschau Deutscher Technik*, Dec. 1937) in discussing this problem points out that the Hengstey lakes built 15 years ago are scoured out during spring floods and the sludge moved to lower stretches of the river. The sludge is sufficiently distributed, however, to prevent nuisances. After 10 years operation no dredging was needed; in cases where the high water is diverted, however, regular dredging is required. Sludge deposition does not appear to be detrimental to the purification power of the lakes.

HIGH RATE FILTERS—Trickling filters through which air is sucked or forced, so that several times the usual quantity of sewage can be applied, are being investigated in different parts of the world. In connection with the operation of such filters several questions have been raised, one of which is what would happen if the air supply were stopped for some time because of mechanical difficulties or power failure. Husman and Lanz (*Gesundheits Ingenieur* 61, 231 1938) experimenting at the Zurich treatment plant applied 200 gal. of sewage per cubic yard of stone for several weeks without aeration. The filter became septic and started to unload after a few days but oxidation was only gradually impaired. Comparing the performance results of the closed non-aerated filter with results obtained during a period when large quantities of air were supplied it was found that the nitrates in the effluent were 13 p.p.m. and reduction of oxygen consumed 38 per cent in the first case, while in the latter the figures were 21.4 p.p.m. and 52.5 per cent respectively. It appears, therefore, that an aerated filter can stand a good deal of abuse before any considerable deterioration takes place.